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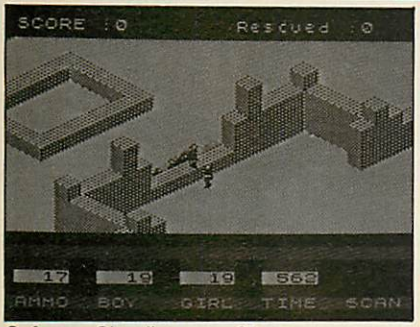
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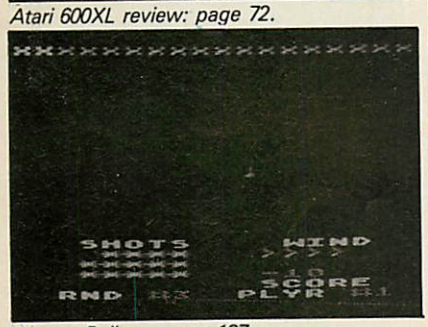
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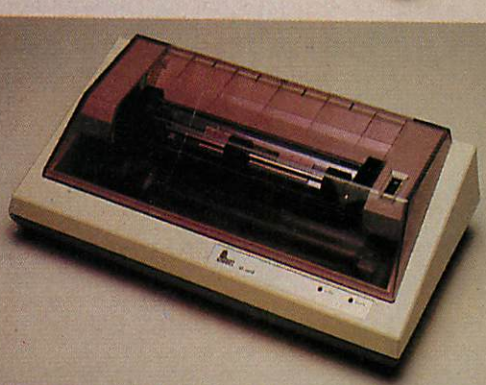
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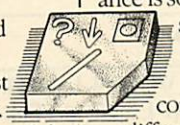
Instead, you learn about its limitations: the dull graphics. The plugs that fall out. The cheap power supply. The unalterable "beginners" language. The stiff, fragile keys. No provision for future developments. If only you'd looked around a bit in the beginning... *"Quality costs a little more, but it's usually worth paying for"* (Personal Computer News – CGL M5 Review, June '83.)

The CGL M5 is designed and built by Sord, one of Japan's leading computer specialists, with three main ideas in mind.

First, to be easy and fun to learn and operate.

Second, to be rugged enough to last through hours and hours of operation.

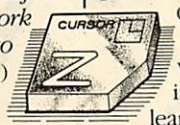
And third, to form the basis of a powerful, versatile home computer system that won't need replacing until you're ready for a dedicated business system.



Built to learn

The CGL M5 is designed to be easy for non-geniuses to use.

"On the M5, most of the work is done for you, and all that is left is the need to work out what to do next, rather than how to do it." (Personal Computer News, June '83.)



If you make a mistake, you can correct it with a simple movement of the cursor. So you only correct that mistake, not a whole line; nor do you have to indulge in complex edit commands.

Budding video game designers and computer artists will love to get their hands on the 16 colour graphics and 32 moveable images called "sprites."

"The M5 makes professional graphic effects very simple for even the beginner to achieve." (Personal Computer World, Aug. '83.)

Built to last

"It works first time, doesn't need a lot of mollycoddling and jiggery-pokery to persuade it to continue to do so, and what's even better, it continues to work well. You don't have to balance cold cartons of milk on the top, shove matches in the back to keep the plugs in, or press the keys with several pounds force to make them respond." (Personal Computer News, June '83.)

Being able to build things that work and carry on working without endless maintenance is something at which the Japanese seem to excel.

Built to grow

To be truly versatile, a home computer has to understand very different things.

So you need different "languages," which the M5 provides by supplying part of its memory in plug-in cartridges.

"The M5 eliminates the worst limitations on machines at this level, which is that they tend to be stuck with whatever language is provided by the management." (Personal Computer News, June '83.)

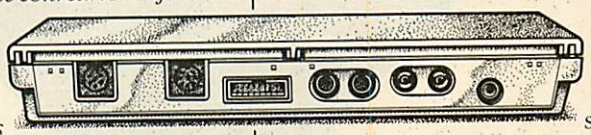
The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

Plug in the Basic-G cartridge, and you can access the M5's incredibly sophisticated graphic and sound capabilities which are far in advance of similarly-priced computers.

Move on to the Basic-F cartridge, and you have scientific, technological and statistical computing power usually available only on big computers with equally big price tags.

The FALC cartridge provides a tailor-made language for data management, spreadsheet accounts and business problems. Combine FALC with a disc and you could *"turn the M5 into a small business machine"*. (Personal Computer Magazine, August '83.)

Now, take a look at the back of the M5.



Notice the sockets (usually an extra) for a standard Centronics-type printer, the separate video monitor and hi-fi sound output.

Even the language cartridge socket has hidden potential:

"Unlike most such sockets, this one has 56 internal lines connected to it giving access to just about every function in the computer. This means that just about everything you can think of can be added onto the computer, ranging from a Prestel interface to second processor to use as an intelligent terminal on a timesharing computer"... (Electronics – The Maplin Magazine, March '83.)

Take a look at the home computer that will improve with age.

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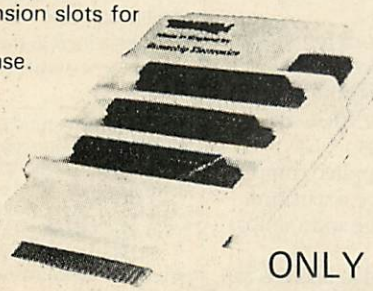
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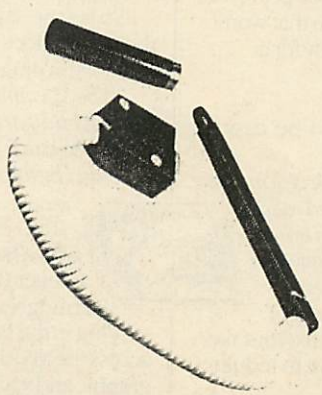
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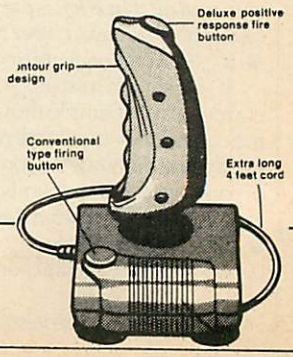


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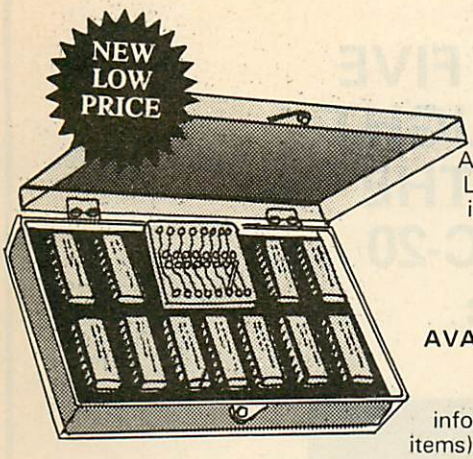


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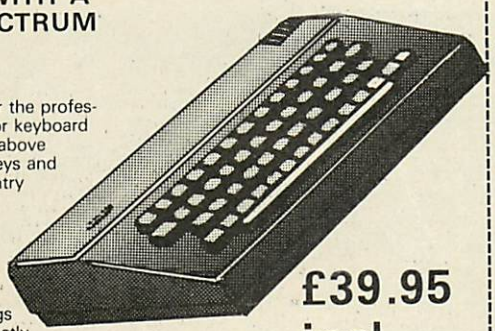
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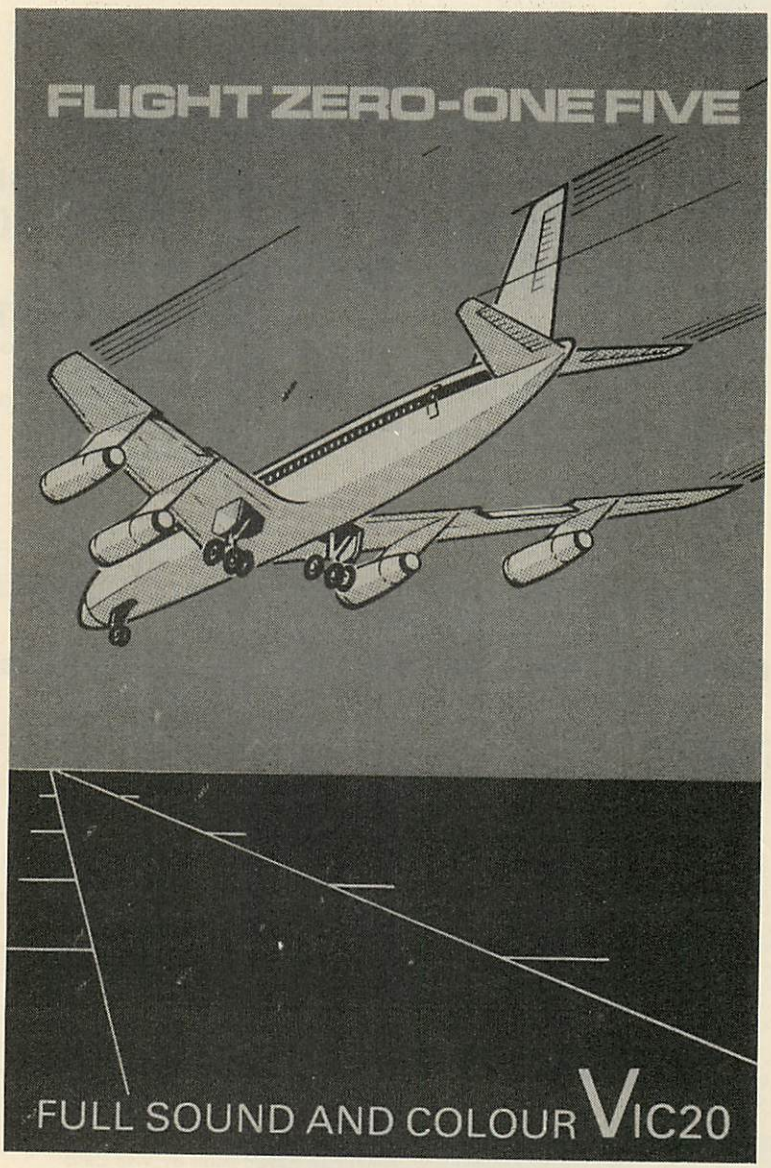
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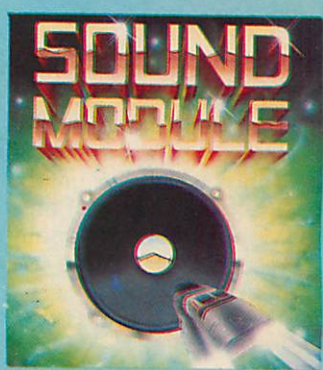
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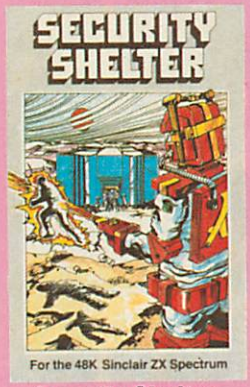
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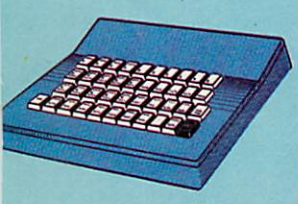
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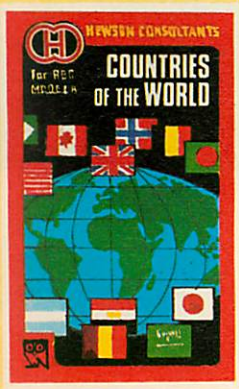


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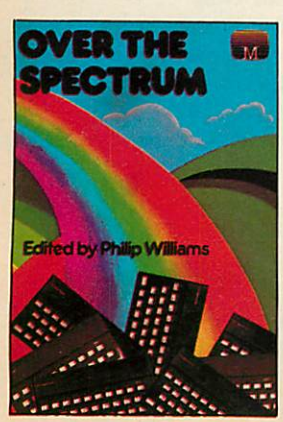
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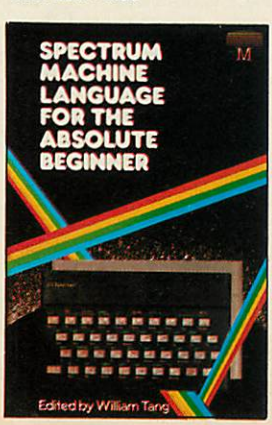
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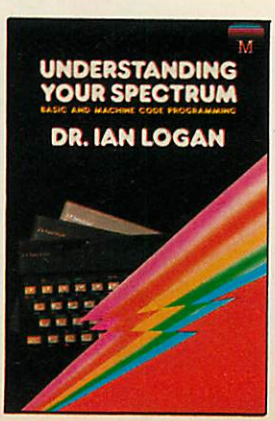
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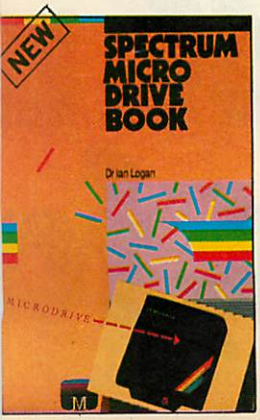
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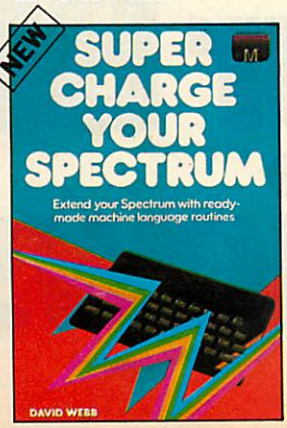


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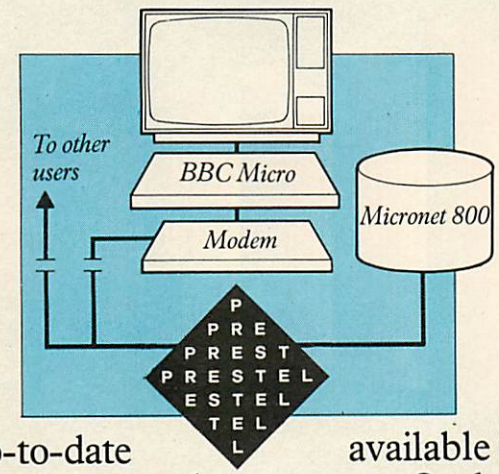


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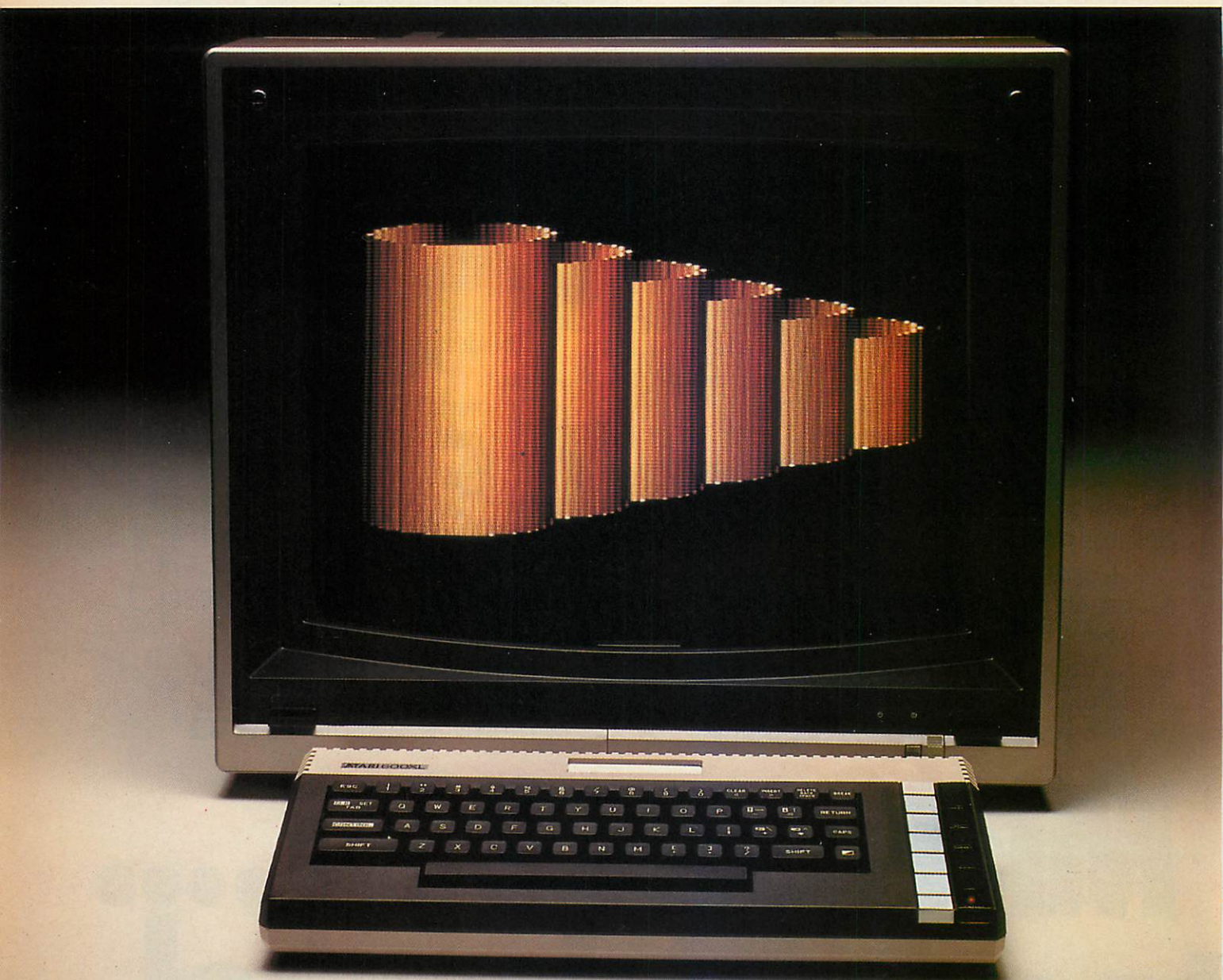
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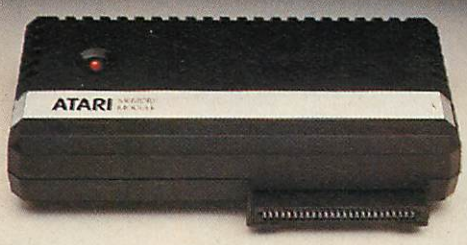
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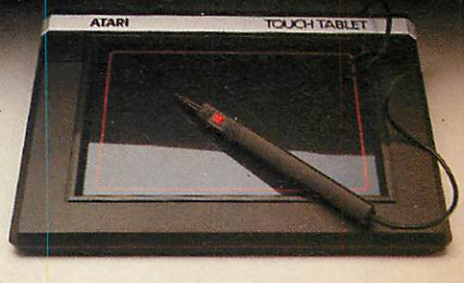
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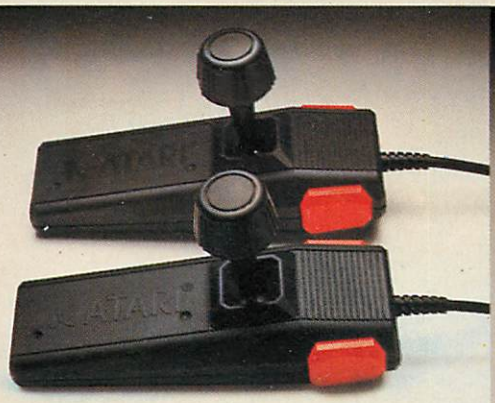
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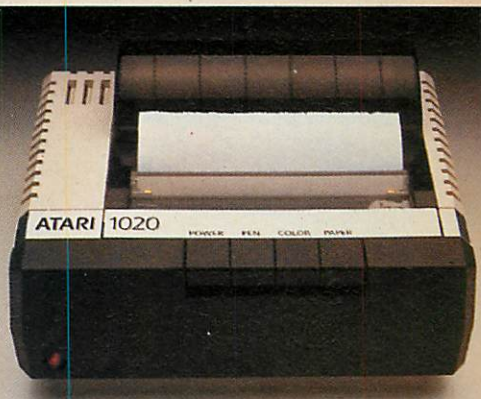
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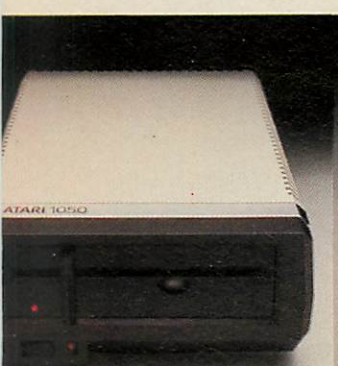
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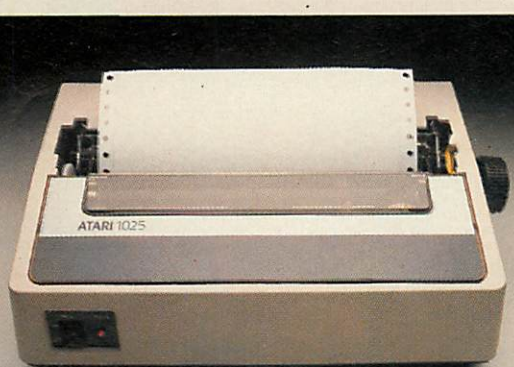
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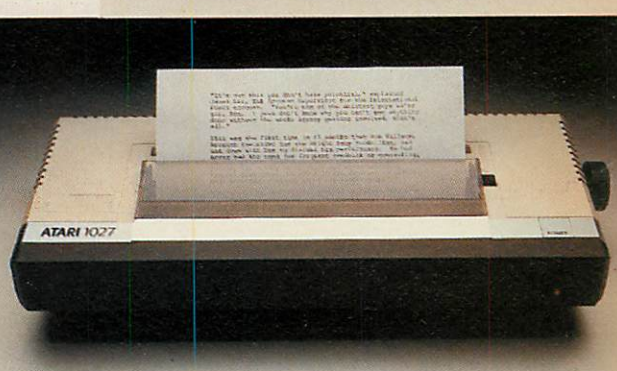
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High scoring game

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CAN YOU SURVIVE this high scoring game?

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The year 2500 A.D. has produced a problem: space Rats are using humanoids for experimentation! Their technical skills include impenetrable defence systems. A Royal Space Fleet Pilot sent to destroy them has been killed. YOU ARE INVITED TO TAKE HIS PLACE . . . .
You will be bombarded by zig-zagging steel arrows – if not destroyed they turn into Thunderflashes which explode when hit. Being unstable they release sparks which you must destroy before they hit you. Your survival angers the Rats who increase the speed and fury of the attack.
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by Neil Streeter

The Martians have invaded, destroying the molecular structure of earth's atmosphere to make it compatible with their own planet. "The girl of your dreams" is trapped at the top of a building site but for the moment protected from the evil invaders by a friendly Dinosaur! Leap over deadly Martian invaders – scale ladders – jump the man traps – rescue her before the oxygen is totally absorbed.
Kong type game for SUPERHUMANS

VIC 20 16K
DRAGON 32K
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COBUS MAZ
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HOUSE OF BUGS
by Tony Frampton

The Bugs in this game will raise your blood pressure to the limits and drive spectators into a frenzy!
In this high scoring game killer bugs roam the top floors. Stay alive by clinging to the ceiling whilst they pass beneath, but you cannot seek refuge on that square again. BUNGE a Bug and gain 50 points, but he may return for his revenge – a vicious ritual followed by your paralysis and death! WATCH the Bugs go hopping mad when target scores give you the services of a blasterer.
Fantastic graphics and sound.

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by Tony Frampton

Can you hold back a relentless army of tanks, sometimes in convoy but often slipping in under the cover of their barrage of gunfire as they try to penetrate your anti tank barriers? Manoeuvre your tank controlling its gun barrel for accurate range. WATCH your salvos disintegrate the enemy BUT BEWARE the deadly return fire. Realistic graphics and sound. Five skill levels – strategy to desperation.

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SPECIAL MISSION
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Your mission starts in a large briefing room: there is a door to the East. You can see a blood stained envelope and a cold strong box, you are carrying nothing at all! TIME is running out, the robots have been activated – WHAT ARE YOU GOING TO DO?
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evels of difficulty.

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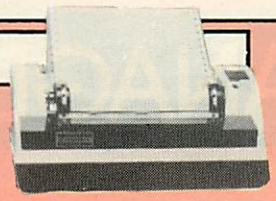
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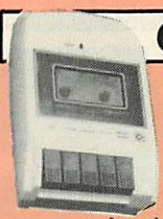
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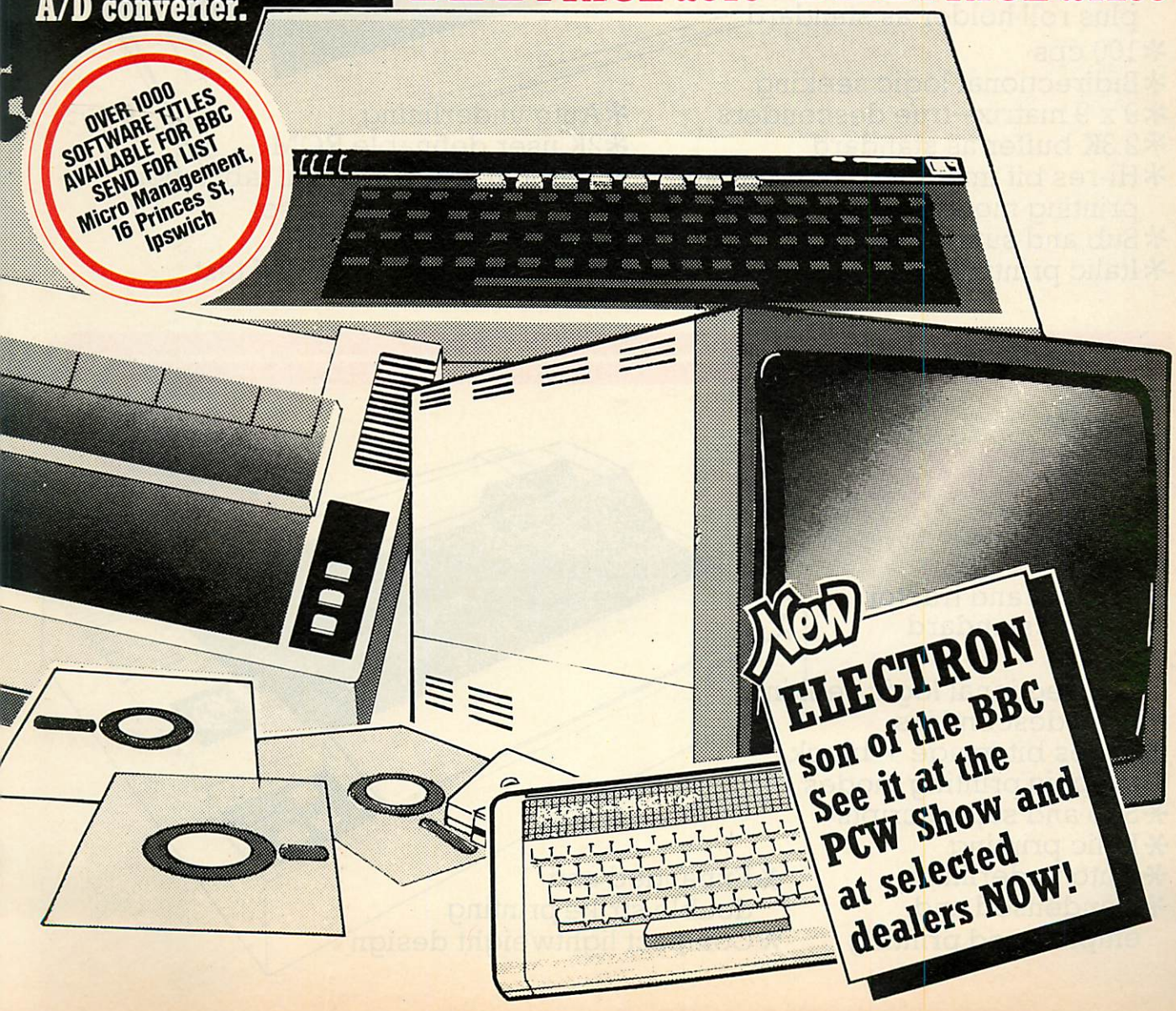
BBC Model B+ Disk Interface+ Econet (fitted)
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PROFESSIONAL WORD PROCESSING PACKAGE

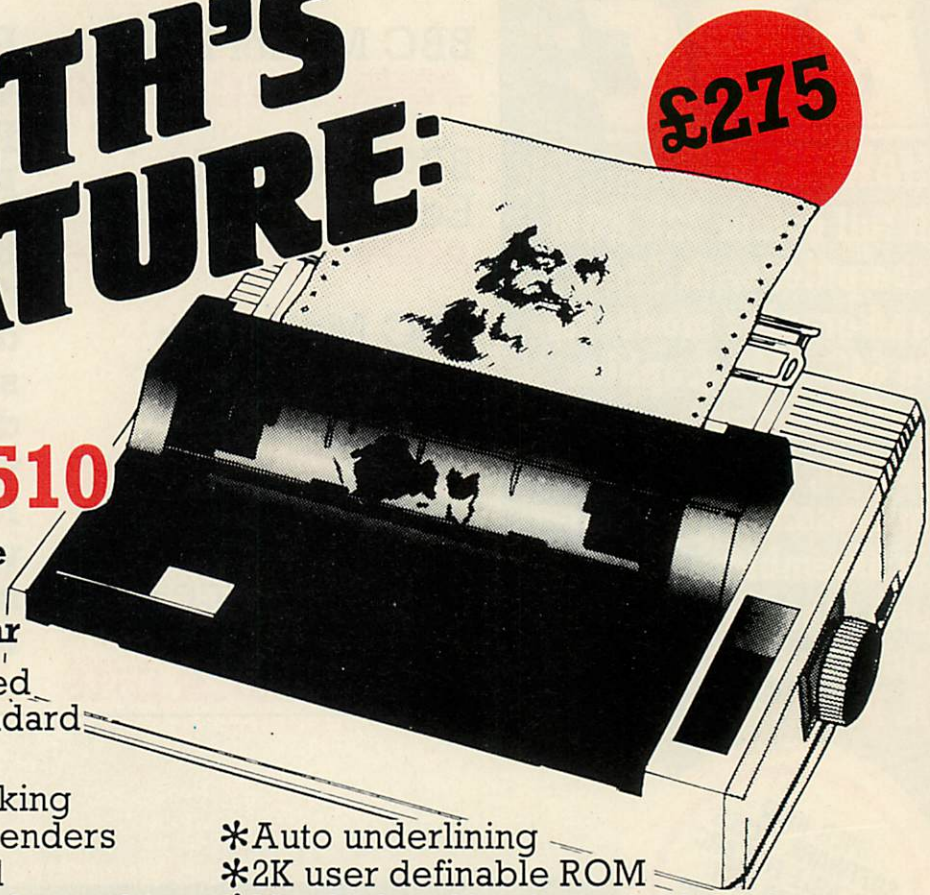
BBC computer with disk interface, 100K disk drive, green screen monitor, daisy wheel printer, word processing ROM, complete with all cables, manuals, paper and formatting disk.

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OVER 1000 SOFTWARE TITLES AVAILABLE FOR BBC SEND FOR LIST Micro Management, 16 Princes St, Ipswich



THIS MONTH'S FEATURE:

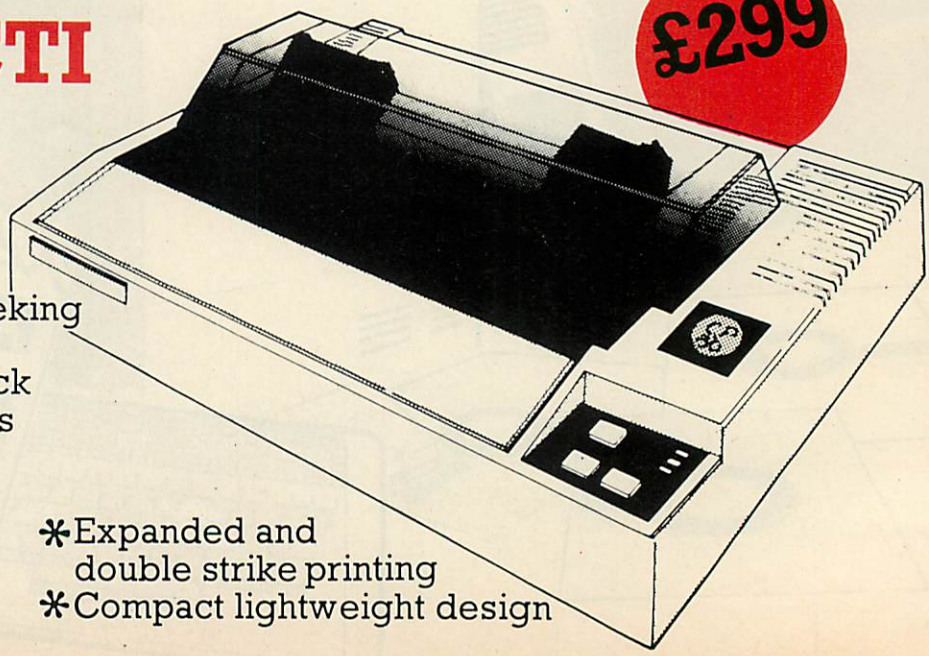


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- ✻Sub and superscripts
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- ✻2K user definable ROM
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- ✻Sub and superscripts
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16–48K, colour, high resolution graphics 240 × 200, text 28 + 40, pre-programmed sound, user-defined keyboard/graphics, non touch-sensitive keyboard, microsoft type basic with powerful extensions, RGB/UHF, standard cassette interface, parallel printer output, several periferals available, printers available, modems and PRESTEL (coming).

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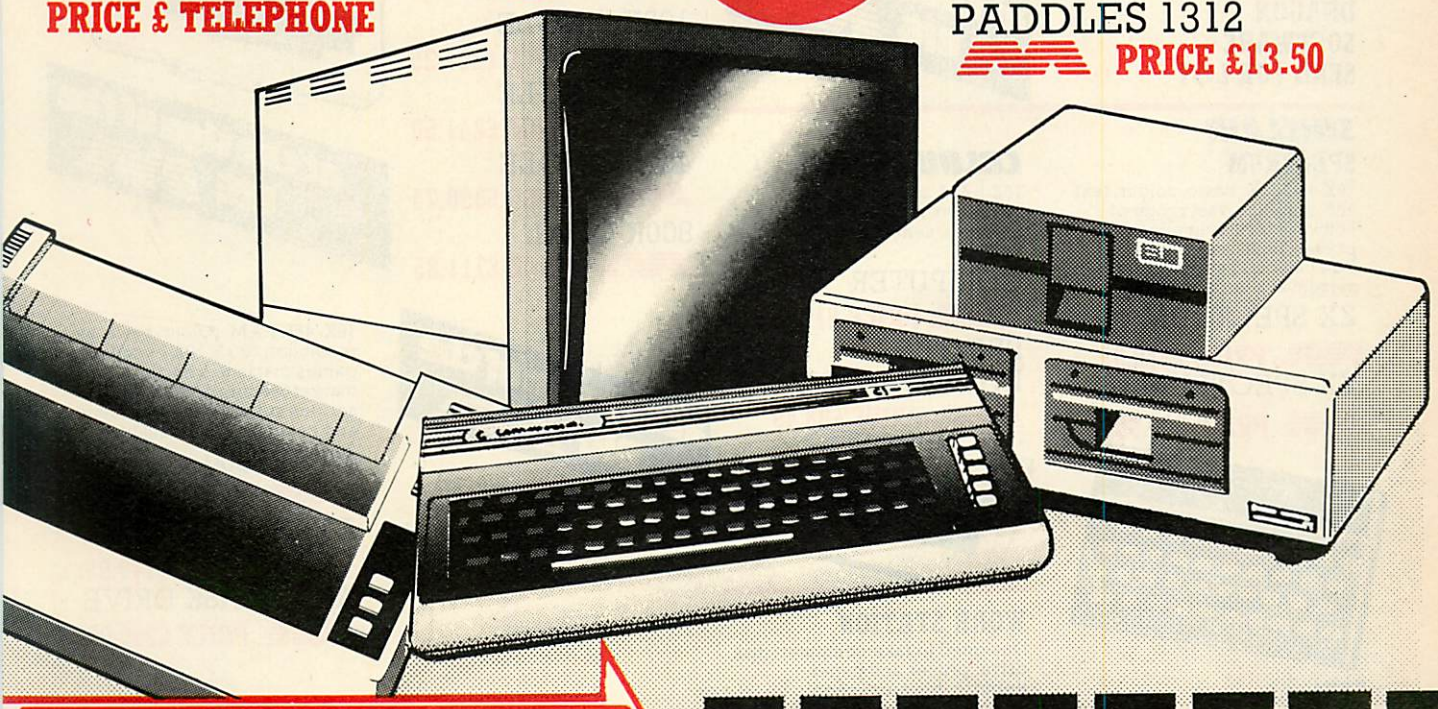
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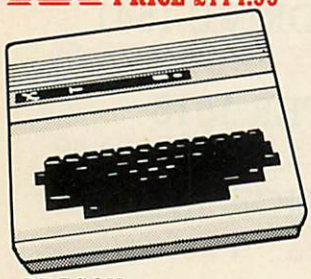
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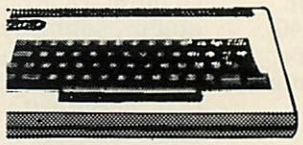
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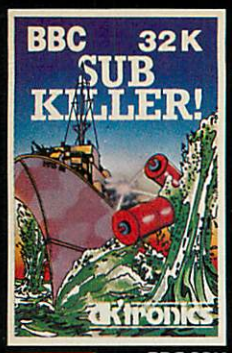
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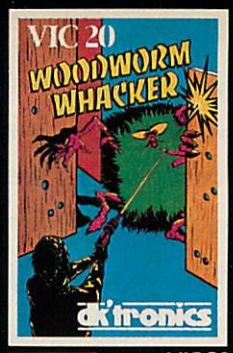
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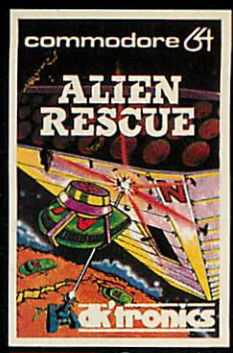
NEW BBC 32K SUB KILLER!



NEW Spectrum STAR TREK 3000



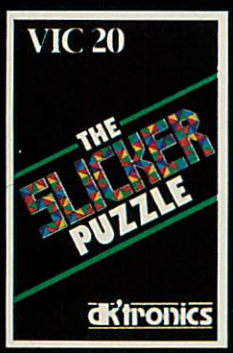
NEW VIC 20 WOODWORM WHACKER



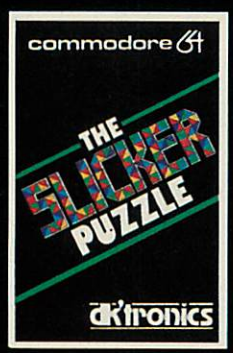
NEW Commodore 64 ALIEN RESCUE



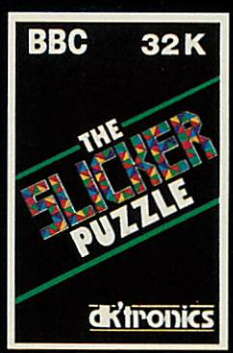
NEW BBC 32K SUPER FRUITS



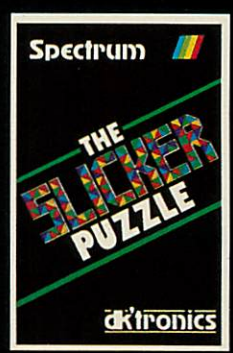
NEW VIC 20 THE SLICKER PUZZLE



NEW Commodore 64 THE SLICKER PUZZLE



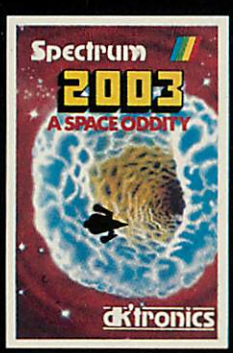
NEW BBC 32K THE SLICKER PUZZLE



NEW Spectrum THE SLICKER PUZZLE



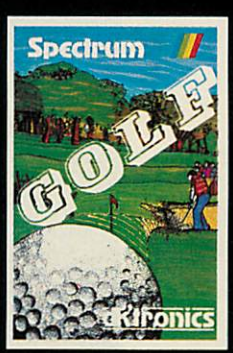
NEW Spectrum TROM



NEW Spectrum 2003 A SPACE ODDITY



NEW Commodore 64 WHO DARES WINS



NEW Spectrum GOLF



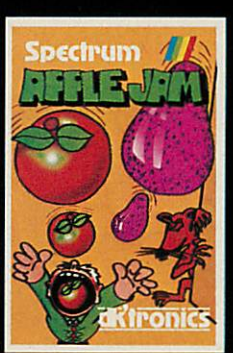
NEW Spectrum MUNCH MAN



NEW Spectrum DIET



NEW Spectrum SPEED DUEL



NEW Spectrum APPLE JAM



NEW Spectrum PERSONAL FINANCE



Spectrum SOUND FX



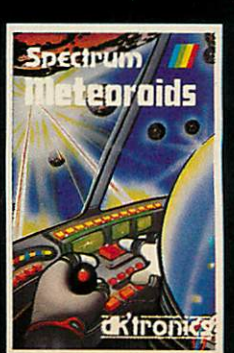
NEW Spectrum MAZIACS



Spectrum 3D TANX



NEW Spectrum HARD CHEESE



Spectrum METEOROIDS



ZX81
3D GRAND PRIX



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Spectrum
ASTRON



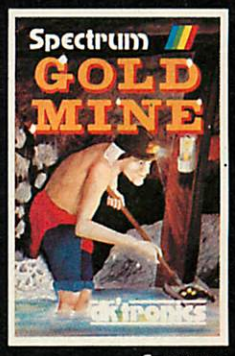
Spectrum
FRUIT MACHINE



NEW
Commodore
64
MILLIE-BUG



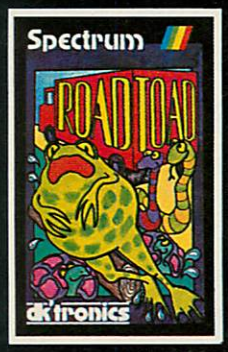
ZX81
ZXED



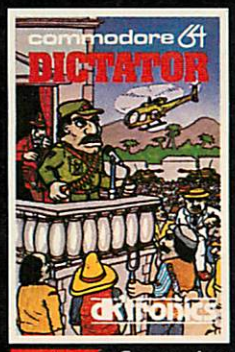
Spectrum
GOLD MINE



Spectrum
SPAWN OF EVIL



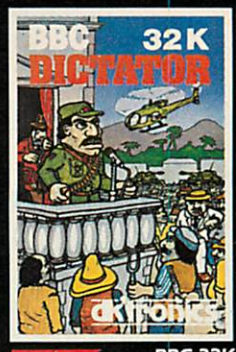
Spectrum
ROAD TOAD



NEW
Commodore
64
DICTATOR



Spectrum
DICTATOR



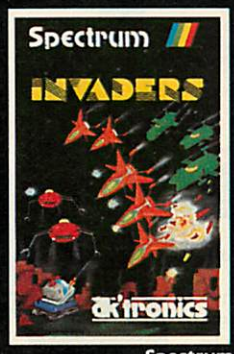
NEW
BBC 32K
DICTATOR



NEW
BBC 32K
PROTEANSE



Spectrum
JAWZ



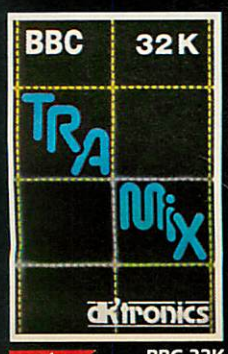
Spectrum
INVADERS



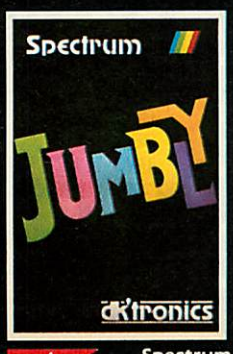
ZX81
METEOR STORM



Spectrum
CENTI-BUG



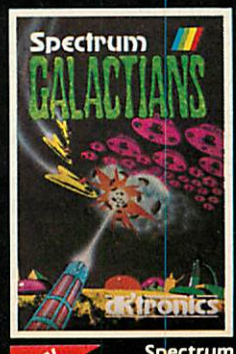
NEW
BBC 32K
TRAMIX



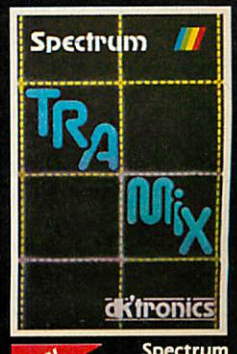
NEW
Spectrum
JUMBLY



NEW
ZX81
EASY



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See page 237 for further details and order form

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Get some real action out of your computer this Christmas with ACTIONMASTER, a new range of superior arcade games from Lothlorien – the people who brought you ROMAN EMPIRE, JOHNNY REB, THE PARAS and other famous WARMASTER titles.

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BEDLAM. An asteroid explosion has catapulted you to the asylum planet BOVRYLL where you are under attack from waves of loathsome creatures – each more vicious than the last. Your only hope of survival is to kill each wave with a twin-firing photon bolt, but just when you think you're winning you encounter the sorcerous guards. Can you kill ten to win another life?

BEETLEMANIA. Trapped in a maze with four giant green beetles you are desperate to get out. You can find a way but the lock can only be opened with four giant beetle eggs. Naturally the beetles go berserk when their eggs are stolen. Higher levels offer more complex mazes and fast-moving spiders.

TWO-GUN TURTLE. In the middle of winter a turtle is defending his strawberry patch against a variety of marauding bugs... some go for strawberries, some go for you... some don't go for anything unless they're accidentally attacked. But remember this is winter and you never know when it might snow!

MICROMOUSE. Watch out for this latest addition to the ACTIONMASTER range.

ALL ACTIONMASTER games are 100% machine code and are available for any Spectrum unless otherwise stated.

LOTHLORIEN

more action for your money

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The Electron. Now it's easier to catch up with your children.

At £199 the Electron is the first home computer in its price range to speak the same language most children learn at school, BBC Basic.

Which is not surprising. For the Electron comes from Acorn Computers who make the much acclaimed Micro chosen by over 80% of schools participating in the Government's Micros in Schools project. As well as using the same language, the Electron has a similar keyboard and many of the functions of its famous, but naturally more expensive, relation.



So now it's more practical for children to continue their computer studies at home.

They'll be able to use the same educational programs they use at school. And if asked nicely, they'll be able to help willing adults take their first steps into computing.

But the Electron is a lot more than a teaching aid. It has been designed and built to be a permanent part of the family year in and year out.

With its fast growing range of software and its ease of use, it should become as essential to the home as the washing machine and the vacuum cleaner. Except, of course, that the number of things the Electron can be trained to do around the house is as limitless as your own interest and imagination.

It can be your book keeper; keep your diary; help in the kitchen – the sort of patient gastronomic expert you've always wanted at your elbow. And of course, it is always willing to play games from blood and thunder entertainments like Monsters to more intellectual diversions like chess.



The Electron is neat and compact. It produces high quality sound and offers colour graphics with the highest resolution of any home computer on the market. And that's not just opinion – it's measurable.

It has been built to last with a robust electric typewriter style keyboard that will take a lot of beating. (Just compare it with the standard calculator type keyboard.)

And it will grow with you via expansion modules to take additions like printers and disc drives.

The Electron plugs straight into virtually any TV set and cassette player. It comes with a user guide, a manual on basic programming and an "Introductory" cassette which will show you a little of what it can do with its 64k of memory (32 ROM; 32 RAM).

You can buy your Electron from selected W H Smith and local Acorn stockists. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200 anytime or 0933-79300 during office hours.



The Acorn Electron.

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The Electron. Now it's easier to catch up with your children.

At £199 the Electron is the first home computer in its price range to speak the same language most children learn at school, BBC Basic.

Which is not surprising. For the Electron comes from Acorn Computers who make the much acclaimed Micro chosen by over 80% of schools participating in the Government's Micros in Schools project. As well as using the same language, the Electron has a similar keyboard and many of the functions of its famous, but naturally more expensive, relation.



So now it's more practical for children to continue their computer studies at home.

They'll be able to use the same educational programs they use at school. And if asked nicely, they'll be able to help willing adults take their first steps into computing.

But the Electron is a lot more than a teaching aid. It has been designed and built to be a permanent part of the family year in and year out.

With its fast growing range of software and its ease of use, it should become as essential to the home as the washing machine and the vacuum cleaner. Except, of course, that the number of things the Electron can be trained to do around the house is as limitless as your own interest and imagination.

It can be your book keeper; keep your diary; help in the kitchen – the sort of patient gastronomic expert you've always wanted at your elbow. And of course, it is always willing to play games from blood and thunder entertainments like Monsters to more intellectual diversions like chess.



The Electron is neat and compact. It produces high quality sound and offers colour graphics with the highest resolution of any home computer on the market. And that's not just opinion – it's measurable.

It has been built to last with a robust electric typewriter style keyboard that will take a lot of beating. (Just compare it with the standard calculator type keyboard.)

And it will grow with you via expansion modules to take additions like printers and disc drives.

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The Advance 86A runs IBM PC software.

Specification

CPU Type	16-bit 8086 running at 4.77 MHz.
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ROM	64K.
ROM Contents	Diagnostics, Basic, Cassette O/S
Languages Included	Basic
Type of Keyboard	Full 84 keys tactile
Keyboard Facilities	10 programmable keys
Character Set	256 in ROM
Method of Display	TV, RGB, Comp/Sync colour or monochrome monitor
Display Facilities	Full screen handling, 4 screen paged
Text	80 x 25 or 40 x 25
Graphics Resolution	320 x 200 or 640 x 200
Colours Available	16
Graphics Facilities	Scroll, reverse image
Cassette Recorder	Audio
Interfaces Included	Cassette port, light pen, joystick, Centronics
Sound	Built-in speaker
Operating System	Built-in ROM
Printers	Any using Centronics parallel interface
Comments	Hardware and software compatible with IBM PC User-upgradeable to Model B Provision for 8087 Arithmetic Processor



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The Advance 86 Model B offers the business micro-computer buyer an IBM compatible disk-based system with twin drives, with Word Star, Mailmerge and Calcstar software (MS/DOS) for only £1200 plus VAT & Delivery.

Advance 86 Models A & B are designed and marketed by Advance Technology UK Ltd.

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Soon English won't be the only common language of British school children.

Today a staggering 83% of all micro-computers being bought under the Government's Micros in Schools project, are BBC Micros.

This overwhelming vote for one machine is, naturally, very flattering to us.

But it is also, coincidentally, very useful for everyone interested in the expansion of computer literacy in schools and beyond.

Because now most children are learning the same computer language – BBC Basic. And it goes without saying that a common language will help everyone move ahead that much faster.



It is of course no coincidence that the BBC Micro is being consistently chosen by schools (and by universities, scientific institutions and business). Nor that it has become one of the top selling computers for the home.

The magazine Which Micro put it rather succinctly in its February issue this year: "The BBC Micro (has) an unrivalled potential for business, educational and serious home applications."

It is, in effect, a home computer with the capacity to do a lot more than you'd expect from a home computer.

It can play games; it can help the children with their homework (there's a huge range of educational software available); it can help with everything from gardening to book keeping.

In fact, it has been called the ultimate home help. But it's a home help with a degree in business administration.

It can, for example, become a word processor and even has the facility to link economically with other BBC Micro's for more sophisticated business use.

With suitable adaptors, it can turn your TV into a Teletext receiver. Programs can also be downloaded from Teletext and Micronet/Prestel transmissions.

Perhaps we can let the reviewer in Video World (Feb '83) have the last persuasive word: "BBC Microcomputers are the limousines of home computers... that would not disgrace the home of a professional."

The BBC Micro costs £399. It is simple to set up (virtually any TV set and cassette player is all you need) and simple to use.

It comes with a comprehensive, step-by-step User Guide which introduces the Micro and shows you how to construct useful programs of your own.

You will also receive a free "Welcome" cassette which contains 15 different programs to experiment with immediately.



It is available from W H Smith Computer shops, Boots, John Lewis and local Acorn stockists.

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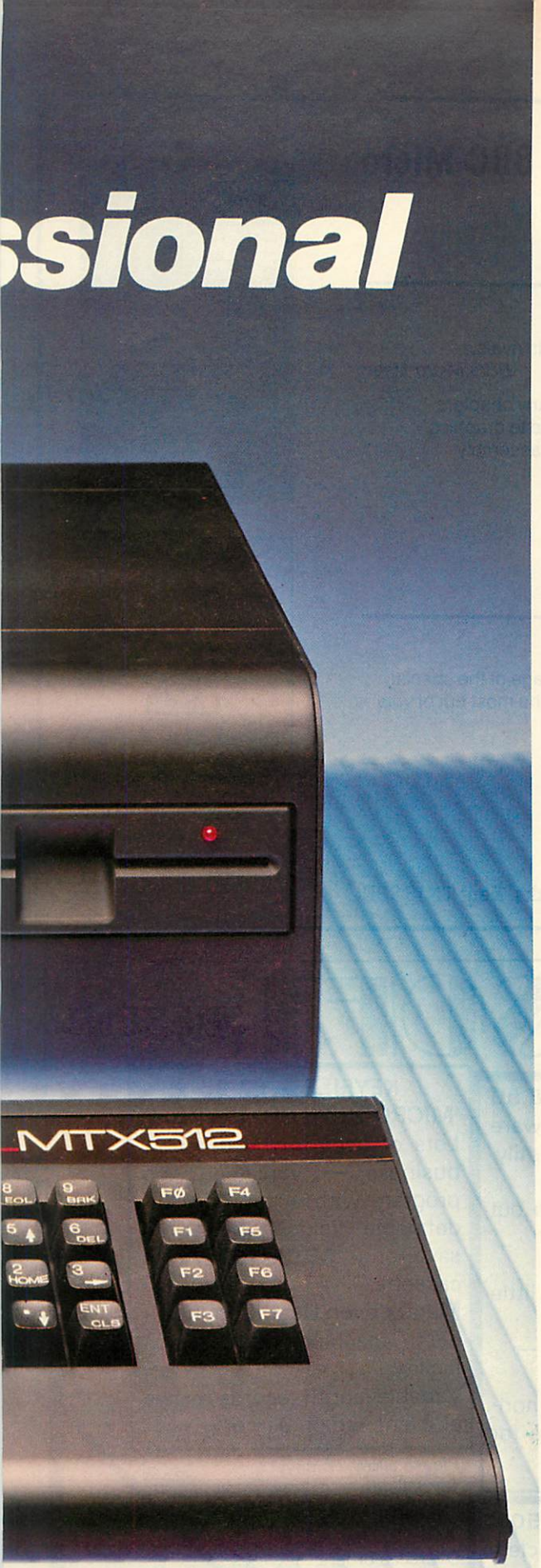
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The MTX Series is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below - you'll see what we mean.

Hardware - 32K RAM on the MTX500, 64K on the MTX512.

The MTX500 has 32K of user RAM as standard (64K on the 512), expandable to 512K plus 16K of video RAM, controlled by a separate Video Processor. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and 32 easily moveable user defined graphics characters (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 4 channel sound with hifi output plus a dedicated cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight 2-function keys and separate numeric pad.

Software

The MTX's 24K ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, MTX LOGO commands, NODDY. ROM routines include an ASSSEMBLER/DISASSEMBLER with screen display of the Z80 CPU registers, memory and program,which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to split the screen into a maximum of eight sections to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

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All Memotech products are designed and manufactured in Oxfordshire, England

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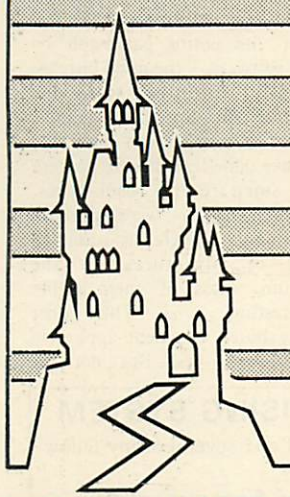
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YOUR LETTERS

BREAK KEY DISABLING: "WE ARE NOT ALL BUDDING PIRATES!"

If, as Tim Hartnell assumed in Response Frame, October 1983, Rupert Hollon was interested in disabling the Spectrum Break key in order to protect his program — a common obsession — then I am surprised he did not tell him about the simple and well-publicised Poke 23659,0 which achieves the desired effect. However, I am getting rather tired of the assumption that we are all budding pirates, an attitude frequently adopted by Mr Hartnell when he jumps on innocent enquirers who ask about taking back-up copies of their programs bought with their money.

Seemingly endless amounts of space are devoted to explaining ludicrously pointless techniques like creating copyright noticing in line 0 Rem statements — forgetting that, in explaining how to do it, one is simultaineously explaining how to undo it — when anyone with the tiniest knowledge of the workings of a machine, or two cassette recorders, can copy anything that paranoid software producers can produce on cassette.

So please software producers and magazine editors, give it a rest and get on with the job of providing good, cheap software and information. No one will stop me taking a back-up of every program I buy — and yes, it really is just for my personal use — and I applaud companies which not only do not stop you doing it, but actually advise you to, as a matter of common sense.

K Gordon,
Crawley,
West Sussex.

COPY COMMAND

Many Spectrum owners with a ZX printer may know that the machine's Copy command may be inadequate as it only prints out the first 22 lines of the display. My short machine-code routine enables the user to copy all of the 24 lines from the display to the printer. Here is the machine-code listing.

```
MACHINE CODE LOADER
  1 DATA 243,6,192,33,0,64,205,
178,14,201
 10 CLEAR 62999
 20 FOR i=63000 TO 63009: READ
a: POKE i,a: NEXT i
 30 STOP
```

If you have a 16K Spectrum, change line 10 of the machine-code loader to

10 CLEAR 31999

To use the routine, type

RANDOMIZE USR 63000

on the 48K Spectrum and

RANDOMIZE USR 32000

on the 16K machine.

Andrew Longbottom,
Rayleigh,
Essex.

PAINT CHANGE

My paint routine published in October *Your Computer* suffers from the irritating problem that the Break key is not enabled during the fill. To rectify this problem the reader should load the 16K version of the program and run this program.

```
10 POKE 32264,237
20 POKE 32265,126
30 FOR I=32493 TO 32507:READ A:
   POKE I,A:NEXT I
40 DATA
197,1, 2,127,237,120,193, 2,
 2,194,113,125, 5,207,20
```

Once run the program will be converted such that Break will work during the fill. To use the relocator program on this version all references to 32500 should be changed to 32510. In Save statements 500 should be changed to 510. Any problems with the use of colour can be removed by calling the routine with:

PRINTY;:LET A = USR 32000 (64800 for 48K)

It should be noted that the characters in the first statement in line 620 are ls and not 1s.

Nigel Dore,
Devon.

HISOFT PASCAL

I was disappointed and annoyed to read the review, by Piers Letcher, of our Pascal compiler for the ZX Spectrum, in the October issue of *Your Computer.*

Not only was Hisoft Pascal 4T a virtually complete implementation of Standard Pascal — including turtle graphics — for the Sinclair Spectrum, compared with a Tiny Pascal for the BBC Micro but also the article contained factual inaccuracies.

The reviewer stated that, subsequent to a compilation, the user is forced to delete the compiler in order to Run the resultant object code. This is totally false; an object program may be Run, the source text edited, compiled and rerun as many times as the user wishes, in a highy interactive manner. It is only when the object code is Saved on tape that the compiler is overwritten in order to make more space for the object program when it is reloaded from tape.

Piers Letcher claimed that our compiler was not "particularly fast". In fact Hisoft Pascal attains very fast times indeed in independent tests, our compiler is only beaten by ProPascal, a compiler running only on disc systems and costing almost 10 times more.

Piers Letcher failed to mention the many features that we have included in our compiler such as turtle graphics, support of the Spectrum sound and graphics, ability to include machine-code Inline, Peek, Poke, User.

David Link,
Hisoft,
Bedfordshire.

SPARE SCREEN?

Less experienced readers who tackled Mark Jones' 3D program for the Spectrum — *Your Computer,* July — may have been baffled by his reference to a spare screen — Mode 3. In fact, this useful facility enables the rotated sketch to appear against any background which the user cares to devise. The technique is as follows.

First, draw a background and Save it on tape using SAVE "name" SCREEN$. Next, decide where in RAM it is to be stored — I placed my screen at address 50,000. Then make the following alterations to the Basic program.

Line 2 CLEAR screen address 1
Line 3 LOAD " " CODE: POKE63466, screen address – 256 x INT (screen address/256):POKE 63467, INT (Yscreen address /256): LOAD " " CODE screen address

I have only one small niggle about this otherwise excellent program. Why did Mr Jones elect unconventionally to make x values positive left of centre and negative right of centre?

Finally, may I urge him not to rest on his well-deserved laurels but to write a Mark 2 version which rotates *solid* ojbects. After all, one rarely sees skeletal tanks moving against a solid background!

D G Clarke,
Brentwood,
Essex.

WOBBLES

ZX-81 RAMpack wobble causes 90 percent of white-outs? Rubbish!! I can wobble my RAMpack, up, down and sideways, with everything remaining OK. Why? How? I will tell you.

Switch off the computer and remove the RAM. Unscrew the four scres that hold it together, then remove the back cover. You will see two circuit boards hinged together. Find a piece of strong plastic sheet. Cut this to about the size of the RAM circuit board, then sandwich this plastic between the two boards. Now put the lot back together again. Switch the computer on, and wobble the RAM till your heart's content.

Certain capacitors on the RAM circuit board can touch on soldered tags. This shorts the soldered tags to the negative can of the capacitors.

A W West.
Potters Green,
Coventry.

ADVENTURE

With reference to Peter Connors so-called adventure review in your September edition, it only goes to prove reviewers general inability to select software. Mr Connors claimed that: ". . . adventure game fans are getting a raw deal . . .". Utter nonsence.

If Mr Connor had bothered to select any of the popular or, indeed, new software I think his ideas about ". . . borrowed scenarios . . ." and "shabby graphics" might have changed. What on earth happened to — Dungeon Master, The Hobbit, Valhalla, Espionage Island and, of course, Pimonia — were they considered old, jaded or boring? Why not review them so we can see! As for the entire paragraph on ZX-81 software — the mind boggles.

Equally stunning were his comments on Spectrum graphic adventures from various houses — who have done their best to obscure their software on back-pages, possibly in shame — were subject to questioning: "There is quite a choice of adventures for the Spectrum, most of them rather uninteresting . . .". This rather vaguely bored comment applies to his software, yes! But not the

ABUSE OF THE ADVERTISING SYSTEM

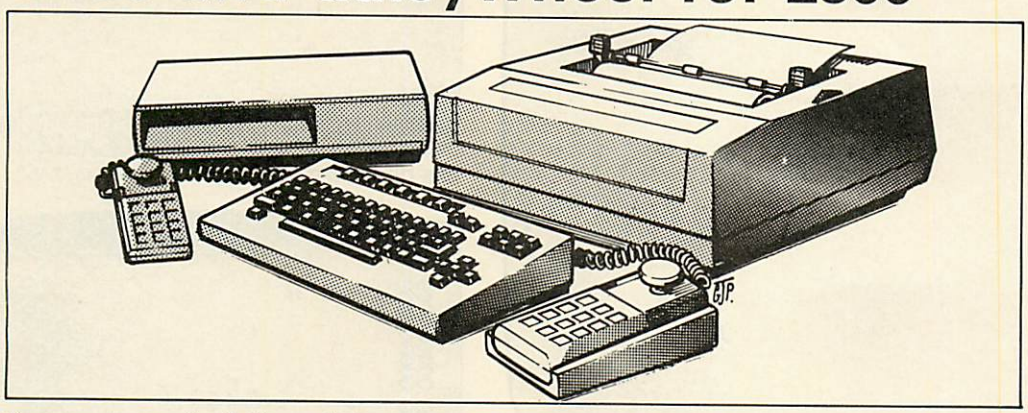
I am writing to air the views of myself and several of my fellow computer bashers.

I never cease to be amazed by the way firms that sell software can so blatantly abuse the system of advertising a product; if the advert does not contain a wildly exaggerated narrative it contains an artistic and eye-catching display which, in my mind, can only be there to deceive the potential customer.

How is it that these adverts can escape the scrutiny of the advertising standards people? Surely it cannot be right to so openly ignore the simple ethics of advertising. It seems to me that a little honesty would do no harm in this field. One firm that strikes me as having the right idea is IJK Software who, as well as giving an outlandish artist's impression to catch the eye of the reader, also includes a picture of the actual screen display. When, I ask you, did you last have a screen sized Dragon, breathing fire or bog-eyed fully kitted Jumping Jack leap out of your TV screen at you? So let us see some standards. It will make it easier for all, most all of us; the poor customer.

T A Le Cocq,
Braunton, North Devon.

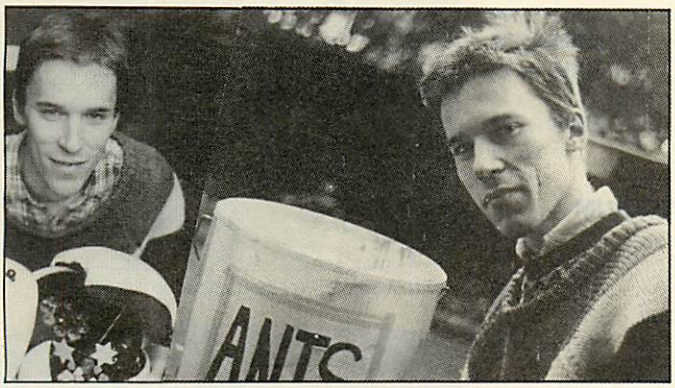
Adam tempts with 80K computer, drive and daisywheel for £500



COLECO IS TRYING to be all things to all men and women with the new Adam computer system. The Adam combines an 80K computer with a real keyboard, two joysticks, mass storage drive and a daisy-wheel printer all for a price of $600 in America which will probably translate to around £500 to £600 in this country. What is more the Adam has a built-in word procesor called SmartWriter and it can use all the software cartridges which have already been developed for the ColecoVision video games machine. A simple add-on allows it to take Atari video games cartridges so it should appeal particularly to people with video consoles who want to upgrade to a home computer without having to junk all the software they have bought.

Usually a daisy-wheel printer on its own costs around £500 so Coleco's complete word processing package will be the cheapest around. The Adam is said to be capable of running CP/M but the problem is that its mass storage system is not a conventional disc drive so CP/M software will have to be transferred on to a special medium. Nonetheless Americans are eagerly awaiting the Adam which goes into production later this month. It will be next year before it goes on sale in Britain.

Latest bulletin: the killer ants move south



TAKE THE HARD WORK out of writing games with some new software packages for the Spectrum. Gilsoft's Quill promises to write adventures for you if you supply the raw material and there are a whole host of programs offering to make it easier to write high speed action games without learning machine code. Scope from Interactive Software People "gives the user the ability to write machine-code routines from within Basic without any knowledge of machine code whatsoever", claims its creator Allen Pendle. In a sense it is trying to do the same job as Fifth which was written by *Your Computer* contributor Richard Taylor several months ago but has only now reached the shops. But if you want to learn how to define shapes and sounds on the Spectrum to produce the best effects without using routines Quicksilva's new Games Designer is a real shortcut. You are given the bare bones of eight arcade games but the exciting bit of the program is that you can customise the games to your own taste. You can replace the Space Invaders, Asteroids or whatever with creatures of your own devising easily drawn on a 12 by 12 grid to create sprites. You can change the patterns of movement and numbers of attackers and even animate them.

Combining a computer printer with a portable typewriter is Brother's idea for success with the EP-22. Used as a printer the EP-22 has an RS-232 interface. It can print on thermal paper or using a carbon ribbon on plain paper. As a portable typewriter the EP-22 has a 2K memory for storing an A4 page of text and a 32 character buffer for corrections. A small 16 character LCD display allows you to view what you are typing. The whole machine is battery powered. Brother is also working on a larger model which will incorporate a word processor and home computer but the big Brother will not be available until late 1984. The EP-22 is distributed by Lowe Electronics which also sells the Colour Genie micro.



Design your own games

LETTING A SCOTTISH sculptor loose on a computer can be dangerous. Sandy White, a 23-year-old Edinburgh sculptor, has written a game for Quicksilva Ant Attack, reviewed in this month's Shortlist, in which giant ants roam the walled city of Antescher — all shown in vivid 3D perspective.

To achieve the program's fast-moving 3D effects Sandy White devised a set of routines which he is now trying to patent under the name 3D Solidsoft.

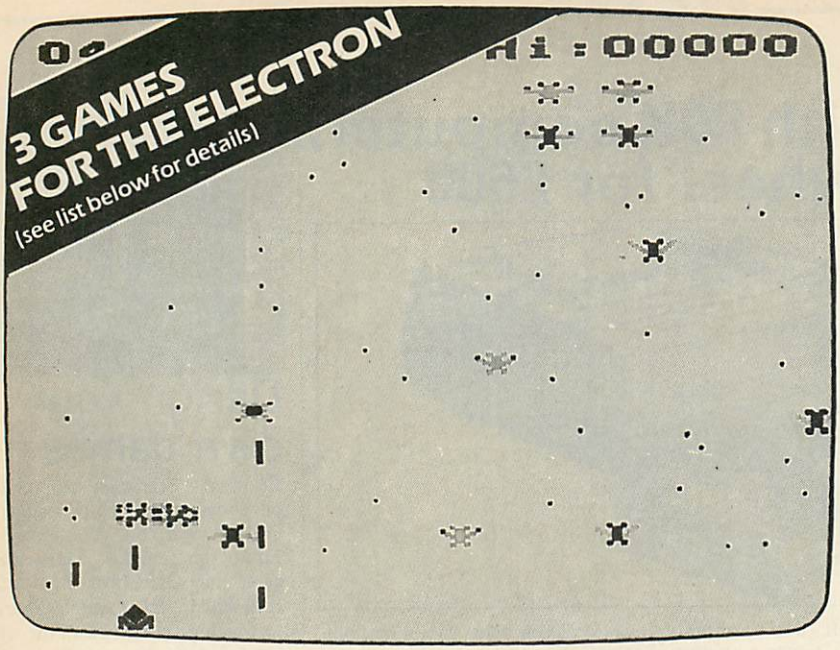
As a sculptor he has successfully combined art and computing. His sculptures are on show this month at an exhibition in Edinburgh titled Press Now For Fresh Ices. All the works are built around microprocessors which are used to co-ordinate light, computer-generated music and such devices as a robot tree.

Sandy White says that he uses computers in the service of art and wrote Ant Attack primarily to pay for the materials in his sculpture.

Colour micros take a tumble through the £50 barrier

COLOUR COMPUTER prices are on the slide again. Mattel is getting out of the Aquarius project after losing the equivalent of £100 million in three months on home computers and video games. Radofin, who make the Aquarius will supply dealers directly and this should bring the price down to £50 or £60 in the shops. Meanwhile 16K Orics are being sold off at £80 through mail order by Tansoft. The demand for the 48K machines is more than 10 times as great as for the 16Ks so now Oric Products International will concentrate on producing 48Ks.





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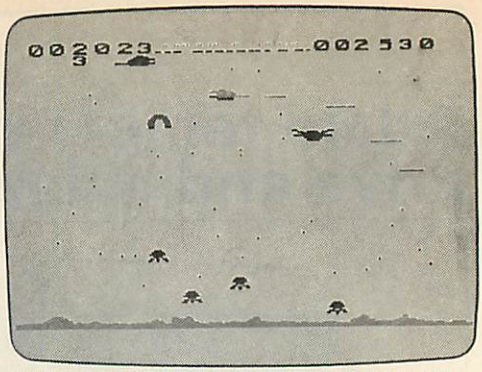
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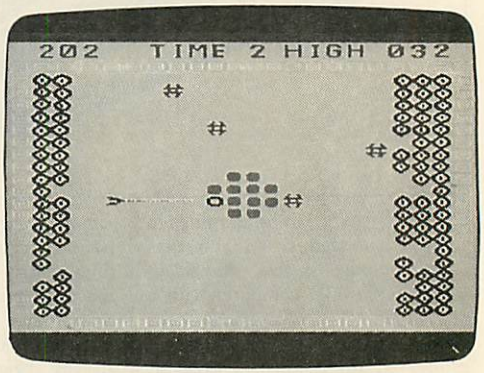
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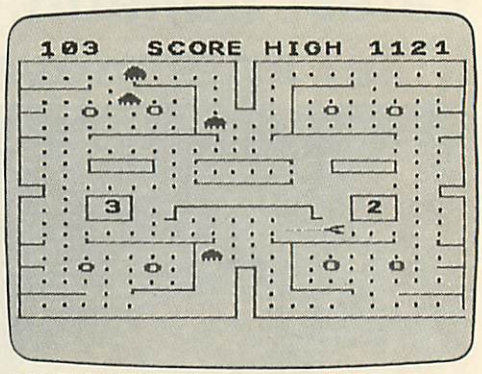
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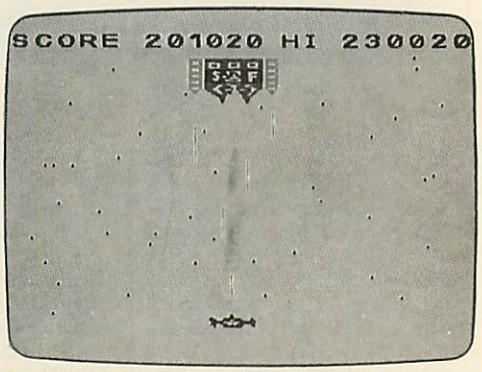
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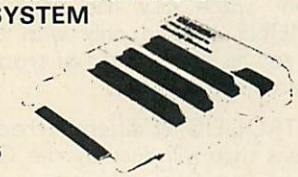
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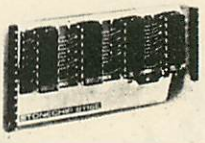


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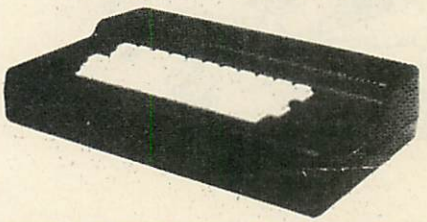
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BEGINNERS first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

I could do that...

All micros have a clock at their heart . . . it is the clock that directs the sequencing of activities within the micro. A typical micro uses the clock to perform several tasks at once: the same cycle — a cycle consists of a set number of pulses of current generated by the oscillator circuit regulated by a quartz crystall - may see the Arithmetic Unit perform an addition between two of its registers, the fetching from RAM of the next instruction — to obey in the next cycle — and the TV screen refreshed.

Now for our competition. We want you to design a clock for your micro . . . it should set a variable to 1 then 0 again at intervals as close to one second as possible; and to display this timing pulse on the screen in some way, together with a count of the number of elapsed seconds so far — so that the clock can be checked for accuracy. So you will need to be able to adjust the timing of your program loop quite accurately: the program must be in Basic, and must not cheat by Peeking the micro's own internal clock!

The winner of September's Binary Subtraction problem was M Fecher, 1 Hungerford Drive, Maidenhead, Berks, who submitted the following program:

```
   1 V$="":Z=0
  10 B1$="1011010111101011"
  20 B2$="1001010110110101"
  30 FOR T=16 TO 1  STEP -1
  40 LET E=VAL(MID$(B1$,T,1))-VA
L(MID$(B2$,T,1))
  60 IF Z>0 THEN 80
  70 IF E=-1 THEN Z=Z+1 ELSE 100
  80 IF E=-1 THEN GOTO 100
  90 E=E-1:IF E=0 THEN Z=Z-1
 100 V$=RIGHT$(STR$(ABS(E)),1)+V
$:NEXT
 110 PRINT B1$:PRINT B2$
 120 PRINT "----------------"
 130PRINT V$:END
```

The sound of micros

"Can you explain how sound is produced on the different micro-computers?"

INEVITABLY, I SUPPOSE, sound came to the microcomputer. In just the same way that graphics and then colours developed, sound has too. Sound, and its implementations, have another similarity with graphics and colour: they are all entirely machine dependant.

It is not simple enough, it seems, to just give a note, and its length and leave it at that, and it was not long before everyone was bogged down into the quagmire of attacks, decays, cut off and band pass filters, and resonant frequencies.

Back to basics. The simplest sound, on a micro at least, is a single note. Attached to this are usually a series of parameters, which control the nature of the sound, but as a basic minimum you have the note itself. The first thing to decide is where this note is going to spring from.



Some computers send it whizzing down the lead with everything else to the TV, and use the loudspeaker from that. Others have their own — generally rather feeble — speakers. Some have both. Computers that have the sound from the TV have the enormous advantage of allowing the user to turn it off. Computers with their own speakers require the anti-sound user to buy cotton-wool — the volume is usually only controllable from within the program.

So what parameters are attached to this note, wafting outwards? Well the most obvious one is length. It is not as simple as that because people like to use different words for it, eg., sustain, duration, period etc., but it boils down to length in the end. The note itself is actually defined by its pitch. This means what note it is.

After the basics, the famous attack and sustain arrive on the scene, together with their concomitant envelopes. Almost any sound that has got attack, sustain and decay defined is called a sound envelope.

(continued on page 61)

Hex to decimal conversion

"Can you tell me how to convert hexadecimal to decimal? Why do programmers prefer hex?"

SINCE-THE hexadecimal system is based on the number 16 it uses 16 digits — just as our normal decimal system uses 10 digits (0 to 9). We use the letters A to F, in hex, to represent the numbers 10 to 15.

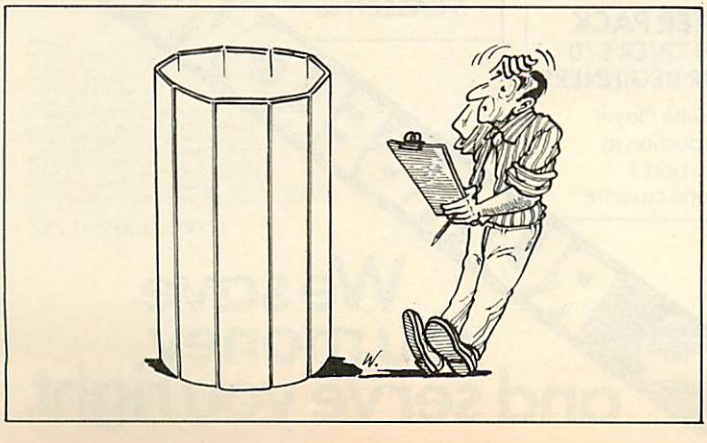
As in any number system the value of a hex digit depends on its position. To understand this cast your mind back to the time when you first learned to count and the idea of column values was introduced — units, tens, hundreds and so on. Thus the digit 3 in the decimal number 340 has the value three hundred since it lies in the hundreds column, while 4 lies in the tens column and is worth forty.

In hex the column values increase by a factor of 16; the first four column values are: 4096 256 16 1. To convert a hex number to decimal simply multiply the digits by the value of the columns in which they fall. For example: 25 (hex) = 2×16 + 5×1 = 37 (decimal) and A0D (hex) = 10×256 + 0 ×16 + 13×1 = 2573 (decimal).

The reason why machine code programmers prefer hex to decimal is that it is much easier to convert to binary; and binary, of course, is the system used by the processor itself.

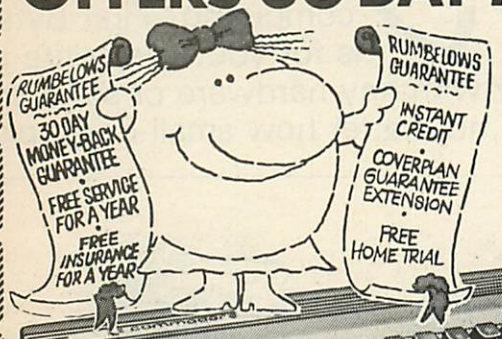
In machine code programmers frequently need to find the value of an individual bit within a byte. The largest number which can be held in a single byte, 255, is FF in hex so each byte can be represented by two hex digits. These give the bit patterns for the first and second halves of a byte.

To take an example, if a byte contains 245 (decimal) what are the values of bits 7 and 3? Are they 0 or 1? — Bits in a byte are usually number 0 to 7 passing from right to left. In hex 245 is F5; F is 1111 in binary and 5 is 0101. It can be quickly see that the seveneth bit is 1 and the third bit is 0. Converting from decimal to binary would be considerably more cumbersome.



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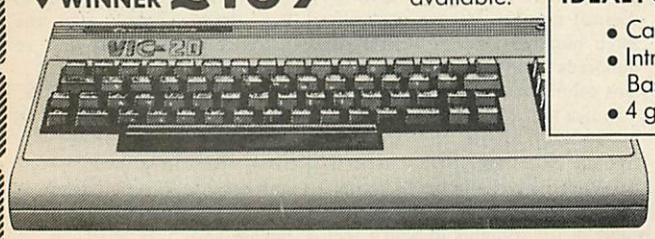


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(continued from page 59)

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The next thing to delve into is the area of white noise. White noise is what you get when you combine many frequencies with about equal energies. In normal terms it is what you get when you drive into something in your car. Crash! as opposed to Beep!

Most computers now have ways of creating white noise, but it is easier on some machines than others. On the Spectrum for example you have to define your own, on the Dragon you have none at all. Whether you are going to have white noise sound effects in your program partly depends on how many sound channels you have got.

Sound channels make the already complex field of sound, more so. Some micros only have the one sound channel — Electron, Spectrum, Oric, Dragon etc. — however others have more — CBM 64, Vic-20, BBC, Atari etc. — and with these you can happily put in a white noise as your background, and then fill in other sounds over the top.

Happily is too strong a word since, in most of the more sophisticated machines, it is incredibly difficult to get a few nice noises to go with your programs. It is this that makes me wish that you could just use musical notation, and say how long you want to play it for. I would not even object strongly to having a few numbered octaves, but to get the sounds you really want takes time.

Admittedly you can get amazing results on the BBC or the CBM 64, even down to getting a beat behind the tune, and several harmonies on top of it, but it is all so laborious. Acorn and Commodore could learn a thing or two from the Oric with its wonderfully named Ping, and Zap commands.

Piers Letcher.

Machine	Number of channels	White Noise	Envelopes	TV/ Machine (Speaker)	Notes
BBC	4	✓	✓	Machine	Some of the best sound anywhere, through SOUND and ENVELOPE calls.
Electron	1	✓	✓	Machine	Like BBC but less so as only one channel.
Spectrum	1	can define it	X	Machine	
Oric	1	X	X	Machine	Predefined sounds save time, e.g., Ping.
Atari	3 + 1 for White Noise	✓	X	TV + Machine	Good, but hard to get what you want. Random noises to choose from.
Commodore 64	3 "Voices"	✓	✓	TV	The best, but so many parameters you need a degree to use it — filters, three wave forms, attack, decay, release, sustain.
TI-99/4A	3 + 1 for White Noise	✓	X	TV	Periodic white noise, or random help the user. A bit tinny though.
Dragon 32	1	X	X	TV	Poor.
Commodore Vic-20	3 "Voices"	✓	X	TV	3 channels, but no envelopes cause a fairly drab result. Not bad though.

drives: pros and cons

"I have got a BBC, and I was quite happy with it until I kept meeting people who reckoned that no micro worth its chips would be seen dead without a disc drive. Are they really worth the expense? After all, for the BBC, you are talking about nearly doubling the cost."

IT IS EASIEST to answer the oft asked question — why bother? — by looking at the differences between disc and tape operating systems. The first and most obvious difference is that disc systems are expensive — tape systems cost nothing theoretically, since micros arrive compatible with tapes, not discs.

For example, on the BBC, first you have to fit a disc operating system — around £100 — and then you have to buy the disc drive — £100 or more depending on how much information you want on a disc eg., double density gives twice as much and, predictably, costs more. Hard discs are also available and are an immensely powerful storage medium so, naturally, they are hugely expensive, and are therefore not commonly used with micros.

Next it is worth pointing out that the storage medium is also much cheaper for tapes than for discs — the latter are about four times more expensive than tapes.

That just about wraps up the advantages of tapes over discs. It is simply a question of how much cash lines your wallet. What is so wonderful about discs then, that manufacturers of drives can charge so much, and still have waiting lists?

First, there is the disc drive's immense speed. Even if you know exactly where a program is stored on tape you have to wait at least half a minute, and up to five for longer programs, to load them into the machine. In a few seconds at most the disc drive loads in your program. How so? Apart from the disc actually going faster than the tape, the searching time is cut down by a process called Random Access.

This is probably the most important difference between tapes and discs. Tape is a sequential storage medium — the information is filed away, one bit after the next, and can only be read back that way — and disc is a random access one — Saved one piece after the next, but any piece can be read back in isolation.

Thinking about music helps: on a record, you can pick any track you like, and play it. On a tape you have to wind through the tape to find the bit you want. This is much the same for computers.

This facility, to look at the whole of the disc without winding through it, allows discs to have another feature sadly lacking on tapes. Directories. These are, as the name implies, a means of finding out information about things — a telephone directory, for example, can be a means of finding out how many people, in a given area, own a telephone.



The sort of directory provided by a disc operating system can vary, from just giving the names of the files, to giving full information about where the file is stored on the disc or, say, how long it is.

Of course, this also allows you to see where the gaps are on your disc, and another feature that disc operating systems — DOS — usually give is that of housekeeping. Housekeeping is what computing folk call the process of tidying up. You would hardly find housekeeping available on a tape system would you?

If you are using a DOS you can also write small programs to do all of your program loading etc. for you, and then Save that on the disc. Loading and running the small program can save you a lot of effort.

In reduction of frustration alone I can recommend the purchasing of disc drives for all. I just wish that they were not quite so prohibitively expensive. Watch out for the microdrive! The affordable alternative.

Piers Letcher

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RESOLUTION	370x470 Pixels	580x470 Pixels
C.R.T.	14"	14"
SUPPLY	220/240v. 50/60Hz.	220/240v. 50/60Hz.
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All micros have a clock at their heart . . . it is the clock that directs the sequencing of activities within the micro. A typical micro uses the clock to perform several tasks at once: the same cycle — a cycle consists of a set number of pulses of current generated by the oscillator circuit regulated by a quartz crystall - may see the Arithmetic Unit perform an addition between two of its registers, the fetching from RAM of the next instruction — to obey in the next cycle — and the TV screen refreshed.

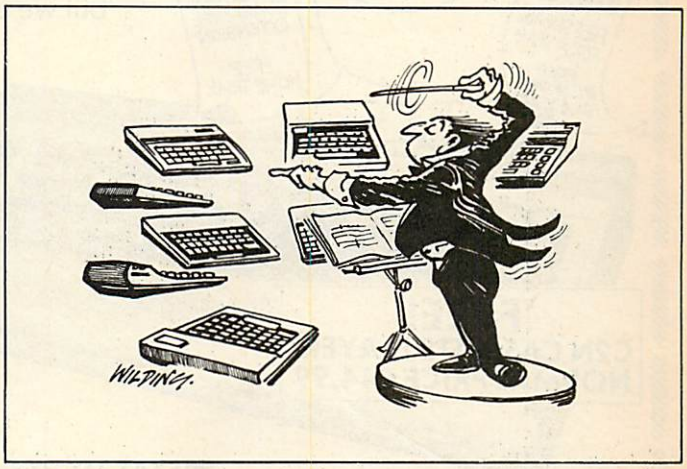
Now for our competition. We want you to design a clock for your micro . . . it should set a variable to 1 then 0 again at intervals as close to one second as possible; and to display this timing pulse on the screen in some way, together with a count of the number of elapsed seconds so far — so that the clock can be checked for accuracy. So you will need to be able to adjust the timing of your program loop quite accurately: the program must be in Basic, and must not cheat by Peeking the micro's own internal clock!

The winner of September's Binary Subtraction problem was M Fecher, 1 Hungerford Drive, Maidenhead, Berks, who submitted the following program:

```
  1 V$="":Z=0
 10 B1$="1011010111101011"
 20 B2$="1001010110110101"
 30 FOR T=16 TO 1  STEP -1
 40 LET E=VAL(MID$(B1$,T,1))-VA
L(MID$(B2$,T,1))
 60 IF Z>0 THEN 80
 70 IF E=-1 THEN Z=Z+1 ELSE 100
 80 IF E=-1 THEN GOTO 100
 90 E=E-1:IF E=0 THEN Z=Z-1
100 V$=RIGHT$(STR$(ABS(E)),1)+V
$:NEXT
110 PRINT B1$:PRINT B2$
120 PRINT "----------------"
130PRINT V$:END
```

The sound of micros

"Can you explain how sound is produced on the different micro-computers?"



INEVITABLY, I SUPPOSE, sound came to the microcomputer. In just the same way that graphics and then colours developed, sound has too. Sound, and its implementations, have another similarity with graphics and colour: they are all entirely machine dependant.

It is not simple enough, it seems, to just give a note, and its length and leave it at that, and it was not long before everyone was bogged down into the quagmire of attacks, decays, cut off and band pass filters, and resonant frequencies.

Back to basics. The simplest sound, on a micro at least, is a single note. Attached to this are usually a series of parameters, which control the nature of the sound, but as a basic minimum you have the note itself. The first thing to decide is where this note is going to spring from.

Some computers send it whizzing down the lead with everything else to the TV, and use the loudspeaker from that. Others have their own — generally rather feeble — speakers. Some have both. Computers that have the sound from the TV have the enormous advantage of allowing the user to turn it off. Computers with their own speakers require the anti-sound user to buy cotton-wool — the volume is usually only controllable from within the program.

So what parameters are attached to this note, wafting outwards? Well the most obvious one is length. It is not as simple as that because people like to use different words for it, eg., sustain, duration, period etc., but it boils down to length in the end. The note itself is actually defined by its pitch. This means what note it is.

After the basics, the famous attack and sustain arrive on the scene, together with their concomitant envelopes. Almost any sound that has got attack, sustain and decay defined is called a sound envelope.

(continued on page 61)

Hex to decimal conversion

"Can you tell me how to convert hexadecimal to decimal? Why do programmers prefer hex?"

SINCE THE hexadecimal system is based on the number 16 it uses 16 digits — just as our normal decimal system uses 10 digits (0 to 9). We use the letters A to F, in hex, to represent the numbers 10 to 15.

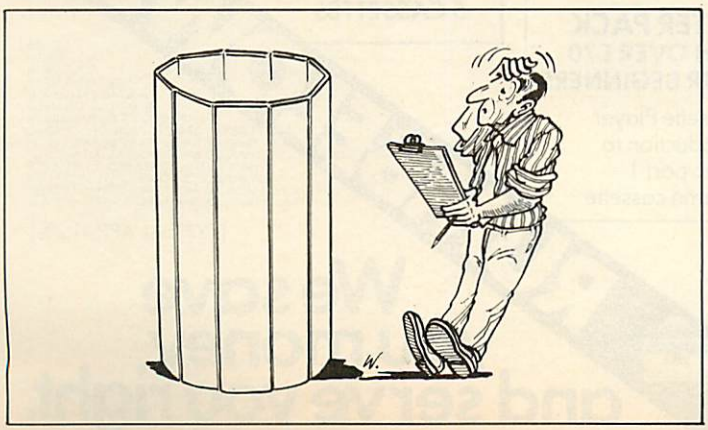
As in any number system the value of a hex digit depends on its position. To understand this cast your mind back to the time when you first learned to count and the idea of column values was introduced — units, tens, hundreds and so on. Thus the digit 3 in the decimal number 340 has the value three hundred since it lies in the hundreds column, while 4 lies in the tens column and is worth forty.

In hex the column values increase by a factor of 16; the first four column values are: 4096 256 16 1. To convert a hex number to decimal simply multiply the digits by the value of the columns in which they fall. For example: 25 (hex) = 2×16 + 5×1 = 37 (decimal) and A0D (hex) = 10×256 + 0 ×16 + 13×1 = 2573 (decimal).

The reason why machine code programmers prefer hex to decimal is that it is much easier to convert to binary; and binary, of course, is the system used by the processor itself.

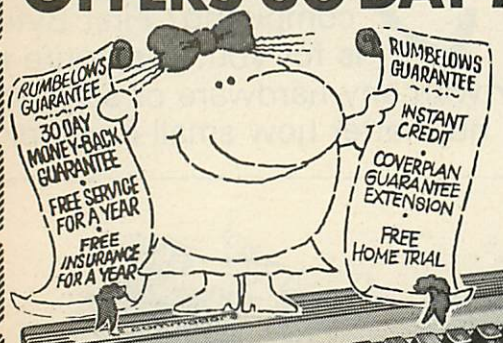
In machine code programmers frequently need to find the value of an individual bit within a byte. The largest number which can be held in a single byte, 255, is FF in hex so each byte can be represented by two hex digits. These give the bit patterns for the first and second halves of a byte.

To take an example, if a byte contains 245 (decimal) what are the values of bits 7 and 3? Are they 0 or 1? — Bits in a byte are usually number 0 to 7 passing from right to left. In hex 245 is F5; F is 1111 in binary and 5 is 0101. It can be quickly see that the seventh bit is 1 and the third bit is 0. Converting from decimal to binary would be considerably more cumbersome.



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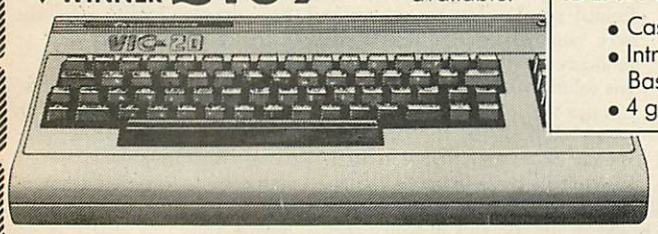


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(continued from page 59)

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The next thing to delve into is the area of white noise. White noise is what you get when you combine many frequencies with about equal energies. In normal terms it is what you get when you drive into something in your car. Crash! as opposed to Beep!

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drives: pros and cons

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Piers Letcher

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(continued from page 59)

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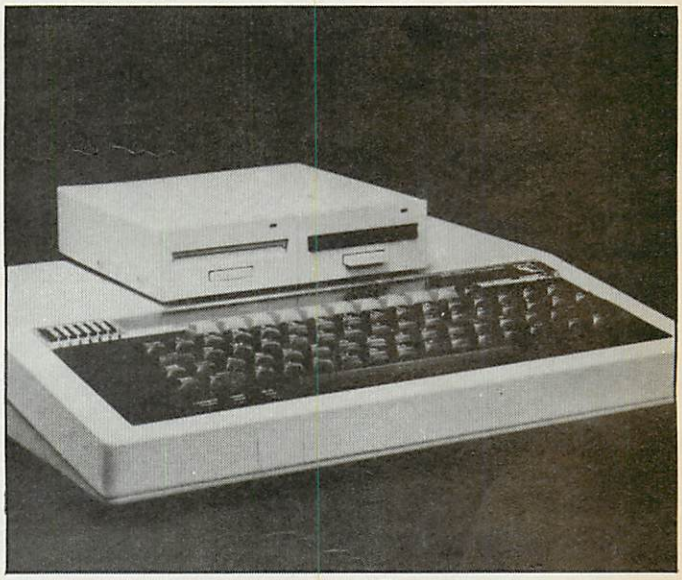
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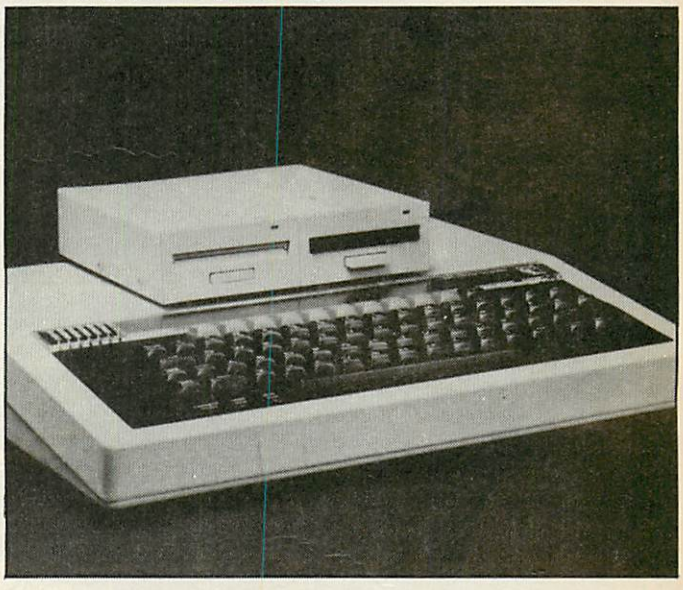
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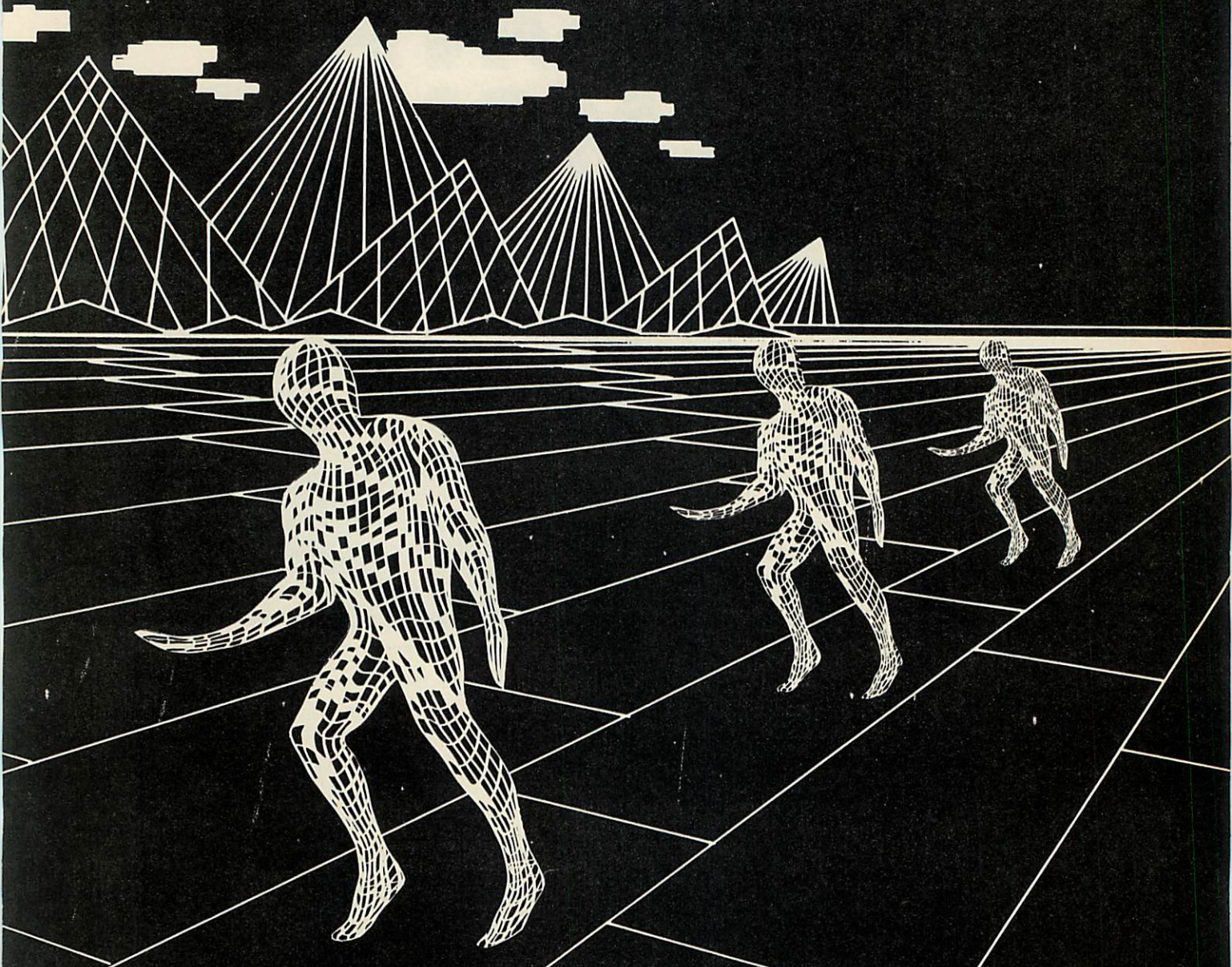
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Travelling to the show is also easy as the organisers have arranged special reduced-price tickets with British Rail which include the cost of admission. For further information ring British Rail Enquiry Bureau on 061-832-8353 before November 11.

The Northern Computer Fair is open between 10.00 am and 6.00 pm every day so come along and bring the microcomputer age alive for you.

For special party rates and further information contact:
The Exhibition Manager, The Northern Computer Fair,
Reed Exhibitions, Surrey House,
1 Throwley Way, Sutton,
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Local news

Derby

On the first and third Thursday of each month at Littleover Church Hall, Shepherd Street, Littleover, Derby, the Derby Micro-computer Society meets. Recent activities have included a computer music session. More details from George Raywer on 0332 769440.

Chesterfield

Another new club, Chesterfield Micro Users Group has been meeting since 23 September at the Hunloke Centre, Church Street South, Derbyshire. One of the group's first projects will be to adapt the Unifile program published in *Your Computer* April 1983 for club registration. For more details contact J R Charter on 0246 37555.

Leeds

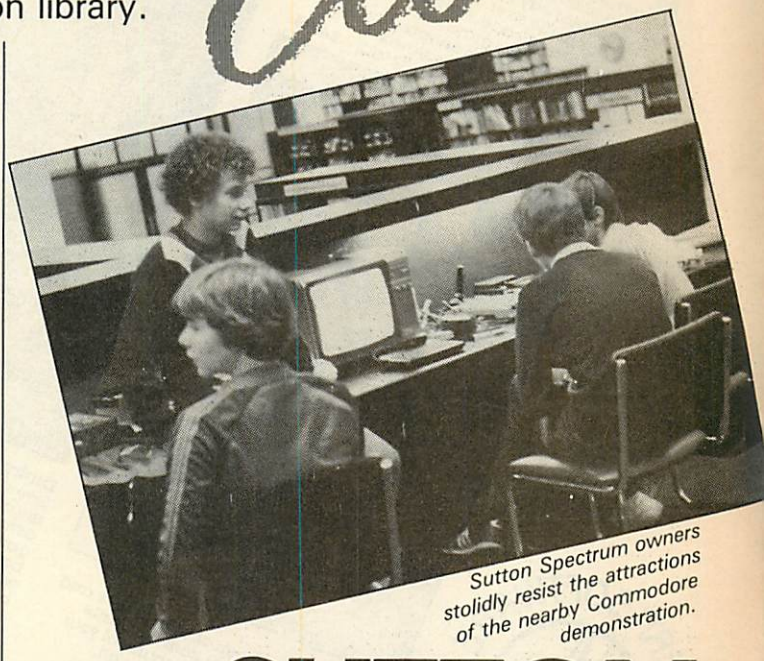
The Leeds TI-99/4A User Group meets weekly at 30 Gipton Wood Road, Leeds 8, on Mondays at 7pm. Telephone Mr I Youlden on 0532-401408 for more information.

Eastbourne

Eastbourne and District Computer Club meets at 7.30pm on the fourth Wednesday of each month at the WRVS centre in Hyde Road, Eastbourne. All are welcome. An informal talk is given at meetings by a guest speaker — recent visitors have included lecturers from Brighton Polytechnic and Sussex University, and there was also a demonstration of the TRS-80 Model 100. A newsletter is produced monthly for members containing hints, tips on programming and a Basic teach-in. For more details, contact Eastbourne and District Computer Club c/o Bob Cooke, 22 Selwyn Road, Eastbourne, Sussex BN21 1LR or telephone 0323-51437.

COMPUTER *club*

Paul Bond nips down the road in search of history and discovers the fictional variety being made in Sutton library.



Sutton Spectrum owners stolidly resist the attractions of the nearby Commodore demonstration.

SUTTON

A MEMBER OF THE Association of London Computer Clubs, the Sutton Library Computer Club meets in the modern civic centre off St Nicholas Way. Sprawling in the shadow of IPC Quadrant House, the distinctive pink skyscraper which is home to such noteworthy journals as *Your Computer* and *Computer Weekly*, the Library provides a spacious backdrop for the display of new technology. Sutton, despite its appearance in the Domesday Book, is a town of the present. Most historical landmarks seem to have been built on, or — as in the case of the elaborate 300-year-old memorial to a noble lady Dorothy Brownlow — hidden behind Sutton Parish Church organ.

Whatever may be lurking behind the Church organ, Sutton's microphiles are keen to delve into a different kind of past, when wizards ruled, dungeons were rotted in and the fairest days oft-darkened by the dread shadow of a dragon's wings. Dungeons and Dragons, or D&D as it is known to neophytes and afficionados alike, is a role-playing game which was the inspiration and incentive behind a lot of the early computrised adventure games. Bryan Neville-Lee was present on the night of *Your Computer's* visit and was duly initiating SLCC members into the weird and wonderful world of CAG — computerised adventure games.

"We ought to be able to approach the game as a team instead of as individuals" he explained. He emphasised the importance of a good referee — Dungeon Master or DM as he is more properly known. People communicate through the DM and the more rules he knows the more flexibility he has. But to introduce newcomers to CAG thinking, the evening kicked off with a simplified home grown computer adventure game. It was hoped that at some future point the game could be transferred to a real setting — it is possible to actually hire a castle to act out an adventure game in.

The size of the Sutton venue lends itself to a multiplicity of activities and, as well as the D&D session and the usual games-playing groups, a local shop was demonstrating its Commodore wares despite the barely-restrained scorn of a nearby clump of young Spectrum owners.

On hand that evening was Len Stuart, one of the Association of London Computer Club's main evangelists, who was involved with David Wilkins and Jennifer Woeller in the founding of the club just under a year ago. There are two meetings every month; the main meeting is held on the fist Friday of every month from 8.20pm onwards, with interest groups meeting on the third Tuesday of every month. Although they had experienced the customary drop in attendance over the summer months, this tendency was not in evidence on the evening of *Your Computer's* visit when at least 40 members were present. The user groups include Sinclair, Acorn, Dragon plus a specialist machine-code group.



Delving deeper into the amazing world of microcomputers

Forthcoming events include a special evening of printer demonstration, more machine code, a retrospective in 1983's new micros and software review for Christmas. Being in a library it is easy to get access to Prestel and Chris Garrat is running a course in computing for beginners. Printer facilities are being obtained and members also get a 10 percent discount from local shops.

Topics covered in recent months have included making music on the BBC Micro, machine codes, Micronet in action and RAM-saving ideas. The SLCC has also been very active in organising computer fairs in the Sutton Library. It would seem that there are plenty of ideas buzzing around the SLCC and that 1984 will be an even more fruitful year. For more details contact Jennifer Woeller on 01-661 5031, or David Wilkins on 01-642 3102. ■

The REAL Challenge!

For your ORIC or SPECTRUM

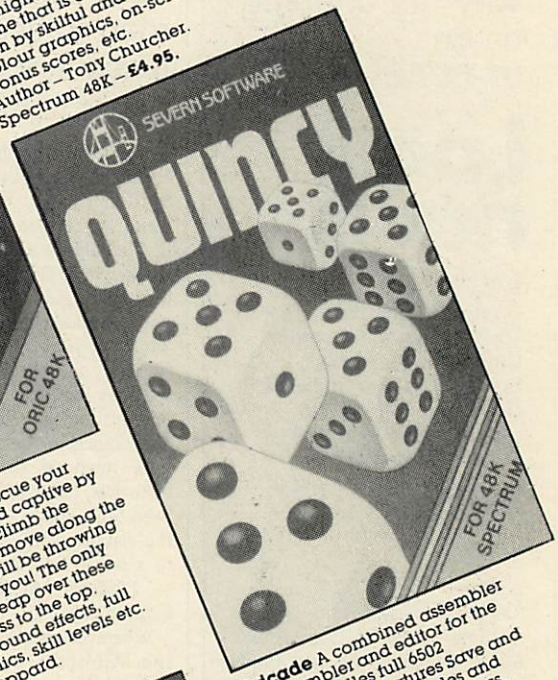
Jogger Guide your joggers across a 4-lane motorway and crocodile infested river to reach their safe haven through the gap in the fence. Each time a jogger is safely home the next one will have to encounter more lorries and cars on the motorway but fewer crocodiles and logs in the river. Full on-screen instructions. M/code, sound effects and full action colour graphics.
Oric Author – Adrian Sheppard.
Spectrum Author – Mike Howard
Oric 48K – **£6.95** Spectrum 16/48K – **£4.95.**





Dinky Kong Attempt to rescue your lovely girlfriend who is held captive by the angry gorilla. As you climb the connecting ladders and move along the gangways, the gorilla will be throwing barrels and fireballs at you! The only way to reach her is to leap over these obstacles and progress to the top. M/code action with sound effects, full colour action graphics, skill levels etc.
Author – Adrian Sheppard.
Oric 48K - **£6.95**

Quincy A superb dice game for 2 to 6 players. 3 throws per go to try and score points by obtaining certain combinations, i.e. 3 of a kind, a run, pairs etc. 13 go's to complete a game. The highest score is the winner! It's a game that is easy to learn but can be won by skilful and thoughtful play. Full colour graphics, on-screen instructions, bonus scores, etc.
Author – Tony Churcher.
Spectrum 48K – **£4.95.**



Oricade A combined assembler Disassembler and editor for the Oric. ★Handles full 6502 Mnemonics. ★Features Save and Reload M/C. ★Assembles and disassembles at any address. ★An essential tool for any serious programmer.
Author – Adrian Sheppard.
Oric 48K – **£8.50.**

Oric titles recommended by ORIC PRODUCTS INT. LTD.

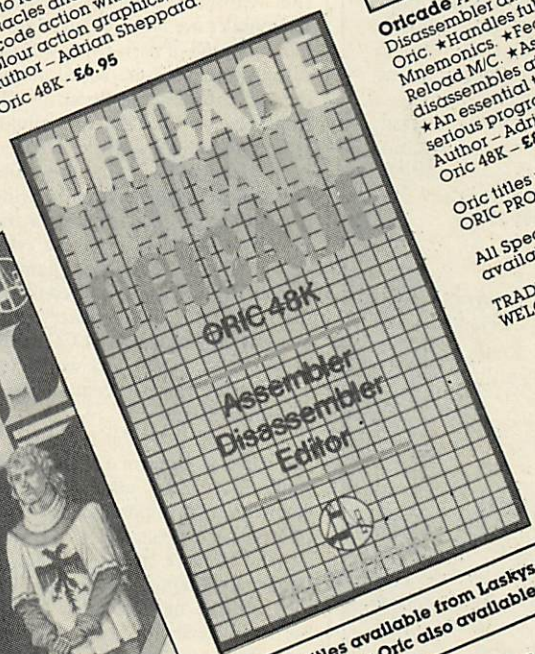
All Spectrum Software is available on Micronet 800.

TRADE ENQUIRIES WELCOME.

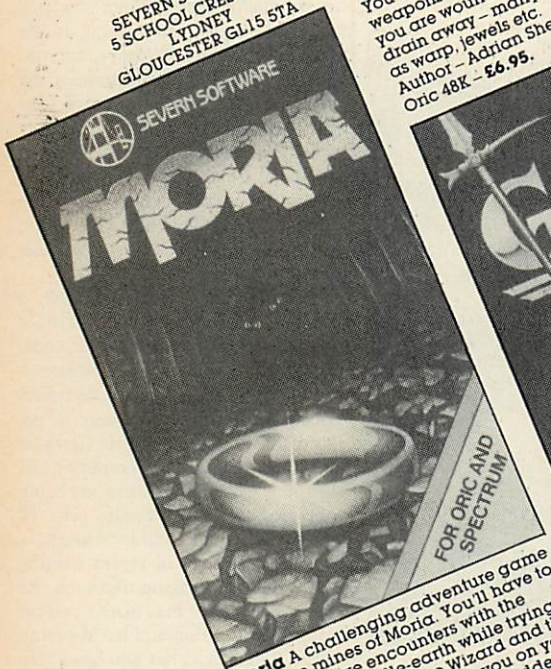
SEVERN SOFTWARE
5 SCHOOL CRESCENT
LYDNEY
GLOUCESTER GL15 5TA

Grail You have been chosen to seek and recover the Holy Grail from the Castle Perilous. Throughout the course of your task you will have to use your skill, intelligence and logic (along with a little luck) as you encounter many foes. You will have the opportunity to gather weapons and armour to fight with, but if you are wounded your strength will drain away – many other features such as warp, jewels etc.
Author – Adrian Sheppard.
Oric 48K – **£6.95.**





Moria A challenging adventure game set in the mines of Moria. You'll have to try and survive encounters with the monsters of middle-earth while trying to locate Durins Ring. The Wizard and the Trader may help or hinder you on your journey to find and open the hidden doors to freedom – a game that will really test your character and staying power.
Oric Author – Adrian Sheppard.
Spectrum Author – Mike Howard
Oric 48K – **£6.95** Spectrum 16/48K – **£4.95.**



All Oric titles available from Laskys.
Dinky Kong for Oric also available from WH Smith.

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- ☐ Quincy @ £4.95
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Overseas P&P add 50p.

YC11

Star chart

California Gold Rush

CBM-64:
Novelty:
ANIK Microsystems:
£7.95

★ ★

A sort of Pacman in reverse. You build fences around your mines while manic indians tear them down and are after your scalp. If you complete a fence you are rewarded with gold. At the higher levels the indians shoot arrows. Your only defence is to dynamite mine shafts so that the indians are temporarily stopped. If an indian catches you one of your lives is lost and your fine head of hair drops to the ground. Graphics are indifferent but an unusual idea holds the attention.

Music Machine

CBM-64:
Novelty:
Commodore:
£7.95

★ ★ ★

This cartridge provides your micro with a synthesiser facility. There are several effects available including decay, glide and vibrato and a rhythm accompaniment is provided. This includes several rhythms whose tempo can be varied using the function keys. The screen shows a musical staff and each time a note is played a crotchet appears in the appropriate place on it. Keyboard is 1½ octaves long with six different octaves available. Limited range but clear sound and good fun.

3-Deep Space

BBC Model B (32K):
Shoot-'em-up:
Postern:
£7.95

★

A new gimmick which may be more of a headache than you bargain for. The 3D effect can and does just work in parts of this shoot-the-aliens game but is extremely dependant on the phosphurs of the screen matching the blue and red filters which must be worn. The game itself is fairly dull and the aliens are almost impossible to hit. Needs improving.

SOFTWARE Shortlist

Ant Attack

■ *48K Spectrum*
■ *£6.95*
■ *Quicksilva*

★ ★ ★ ★

THERE HAVE BEEN 3D games before, of course, but never one so quick or effective as Quicksilva's Ant Attack. Not only is the Softsolid 3D — Patent Pending — remarkably good, but the game itself is exciting and intriguing.

The location is the "walled city of Antescher" and, indeed, the city's buildings do resemble the geometrical paradoxes of the artist Max Escher. Walls, blocks and steps combine to make a huge maze in which roam the giant ants.

These ants are truly fearsome insects, huge and gobbling with enormous jaws. The object of the game is for your man or womand — this is a non-sexist game — to enter the city and rescue the captured loved one who the ants have somehow tied to a slab somewhere in the maze. You can rotate, move forward and jump to safety as the ants gang up and come after you.

As you progress through the city you often lose sight of yourself because of walls and towers. But one flick of a button and you have a choice of four different perspectives. This can sometimes be rather unpleasant; you change to another view only to see yourself being eaten alive in a corner by a pack of hungry ants. Such gruesome experiences can be avoided by judicious use of the grenades you have, though care must be taken not to blow yourself up.

Ant Attack impresses chiefly because of its graphics and 3-D, which are truly admirable. The game itself can prove to be awkward, given the large number of keys which must be controlled. But it is certainly worth investigating for the joy of its 3D effects.



Pinball Arcade

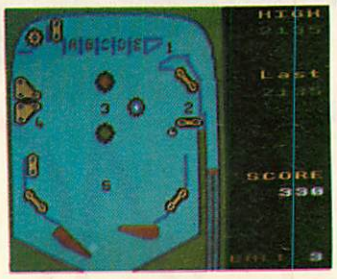
■ *BBC Model B Micro*
■ *£10.35*
■ *Kansas City Systems*

★ ★ ★ ★

ONCE UPON A TIME adults would moan about children wasting their time on pinball machines. Then came computers, and they moaned about children wasting their time on video games. Now we have Pinball Arcade from Kansas City, and adults can have it both ways.

Unless, of course, the adults are playing pinball too; which is very likely, as Kansas's Pinball Arcade is a superb program that is more than just another game. Its great virtue is that it allows you to design and build your own pinball machine.

Once loaded the program displays



the playing surface on the left of the screen. On the right is the menu; Play, Build, Bounce etc. Using the cursors to guide across, you select an option and then proceed to deconstruct and build anew. You can alter the bounce of each component to build fast or slow machines, or a mixture of both.

After constructing your machine you might like to play a game or two. Then you realise that this program is a perfect simulation of pinball.

Both graphics and colours in Pinball Arcade are excellent, much better than a similar program available for the Apple, and the sound too is a fair simulation of a machine. What you miss, though, is the physical contact with the machine. But perhaps this is not very important; what is good about this program is the interactive element, building your own design.

Storm Arrows

■ *Dragon 32*
■ *£7.95*
■ *Dragondata*

★ ★

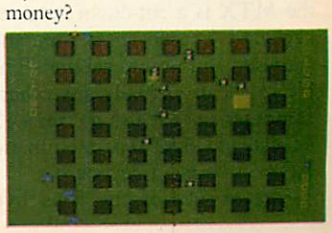
STORM ARROWS OWES a lot to Gridrunner in concept and, as far as the Dragon implementation of the latter game is concerned, Storm Arrows is probably more aesthetically pleasing.

At the start of the game a title screen is displayed, followed by a screen asking the player to input three initials. Once this has been done the game starts automatically. A green and pink grid is displayed. Against this pilious backdrop you must fight out the grim galactic struggle for survival that is only too familiar to many of us.

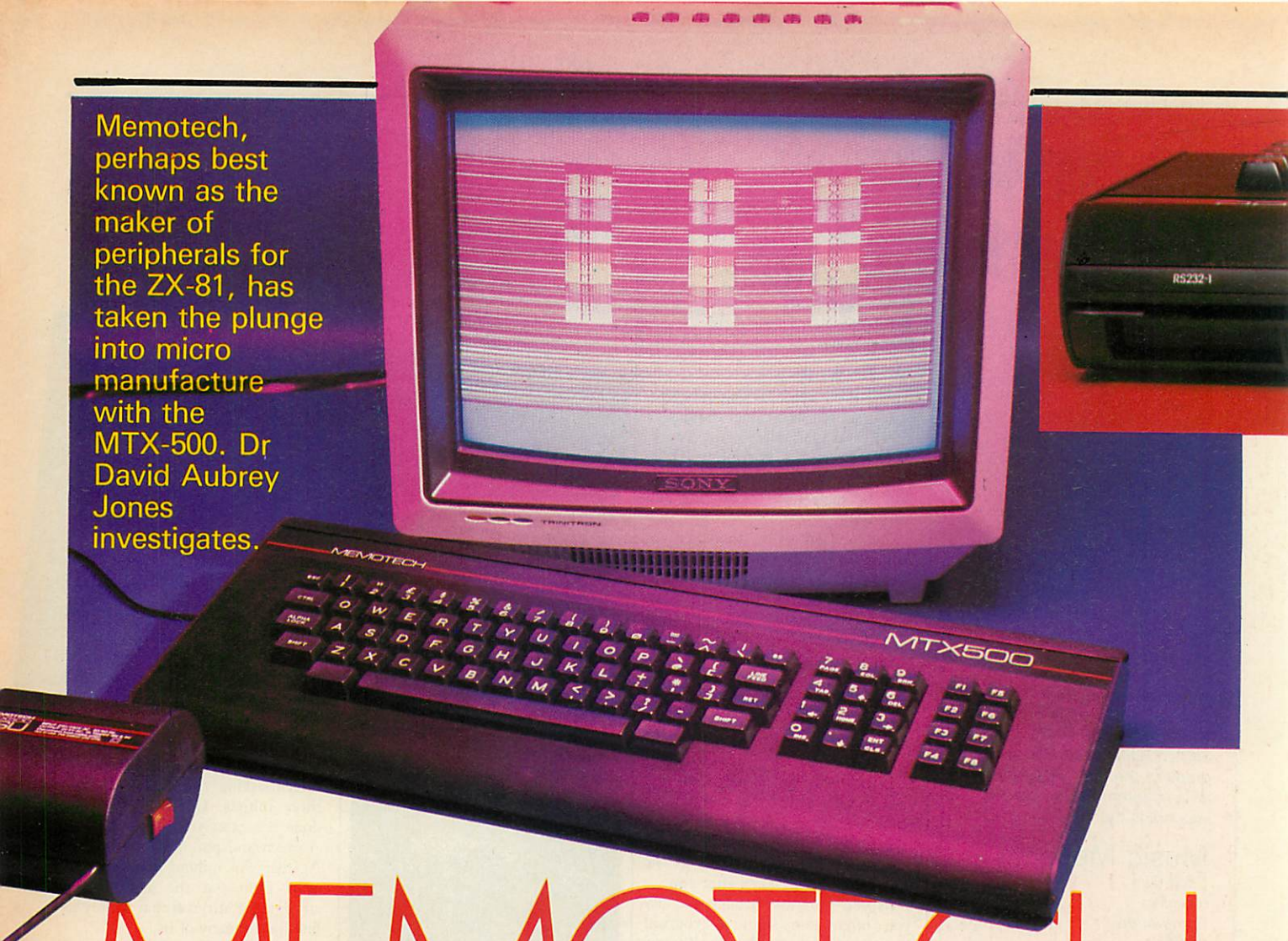
You start off with eight hostile arrows which move around the grid in all directions. Steering your laser weapons using the right joystick, try to destroy the arrows by pressing the fire button. Every time an arrow is consigned to oblivion you gain points but, obviously, every time you fire, you use up energy. All this is inidicated on the screen display. The power remaining is shown by a chequered stripe in the lower right hand corner of the screen.

Periodically one of the squares on the grid will flash and a Master Arrow will appear to deposit square eggs on the grid. If they fall in the centre of your space corridor this is fine, you can zap them, but sometimes they fall slightly off-centre which means you cannot hit them unless you crash into them. You do not score any points for breaking eggs, but the game is only complete when the screen is clear of arrows and eggs alike. From time to time an oval pool appears. Running over this boosts energy.

Given the limitations of the machine this is a good test of your responses, but once again we have to say — is it worth that amount of money?



Memotech, perhaps best known as the maker of peripherals for the ZX-81, has taken the plunge into micro manufacture with the MTX-500. Dr David Aubrey Jones investigates.



MEMOTECH

IN THESE DAYS when the price of microcomputers falls daily and the news of heavy losses by computer manufacturers is rife, it is a brave company that plunges into the fray with a new computer. That is exactly what Memotech has done. Memotech will already be familiar to ZX-81 owners as the maker of a wide range of high-quality peripherals for that machine. Now the company has left this safe and familiar path and produced its own computer, the MTX-500.

When everyone else seems to be fighting to produce the cheapest computer with both colour and sound Memotech has taken a very different approach. Leaving its ZX-81 beginnings far behind it has produced a computer that would not disgrace any executive's desk. The cost is £275.

The styling of the MTX-500 is striking. In fact it looks more like a 16 bit business computer than a home micro. When I first set eyes on it I mistook it for the SM1, the business computer from Memotech of which the MTX is a cut-down version. It has a real keyboard housed in a slim and solid black anodised aluminium cabinet. This is longer — 1'7" — than virtually any other home microcomputer since it also houses a 12-key numeric keypad and eight separate function keys to the right of the main keyboard.

The quality of the keys lives up to the general appearance. They have a professional and solid feel and a touch typist would feel at home with them. Word-processing would be a joy. They are far better than the soggy feel of the Commodore 64's keys. However, one slight niggle — the Return key, used almost more than any other key when programming, is little larger than the standard keys.

There are well recessed sockets at the rear of the MTX for all the usual connections: power, TV and cassette — mic and ear. In addition, all the hardware and sockets are provided to connect a monitor, Centronics-type parallel printer and two joysticks. Any Atari-type joystick is compatible and operates by emulating the cursor keys. This means that there are no expensive extra add-ons to buy in order to play games. Positions for two RS-232 sockets are also provided at the rear, and on the left side there is a cartridge port.

Memotech has stayed on familiar ground with the central processing unit. This is a Z-80A — running a 4MHz — as used by Sinclair in its ZX computers. Perhaps more importantly, it allows CP/M compatibility. This is the disc-filing system used on the vast majority of microcomputers in business. Since a program written on one CP/M machine can be transferred and run on almost any other, this opens up the possibility of the vast range of business programs.

This is an avenue Memotech wishes to explore to the full. This month should see the launch of its colour CP/M floppy disc system

Table 1. Benchmark speed tests — time in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	MEAN
ZX Spectrum	4.4	8.2	20.0	19.2	23.1	53.4	77.6	239.1	55.6
Commodore 64	1.2	9.3	17.6	19.5	21.0	29.5	47.5	119.3	33.1
MTX-500	1.6	4.8	11.3	11.0	13.2	23.9	43.3	44.9	19.3
BBC B	0.8	3.1	8.1	8.7	9.0	13.9	21.2	49.9	14.4

Table 2. MTX standard Basic commands.

ABS ASC ATN AUTO CHR$ CLEAR CLS CONT COS DATA DIM EDIT EXP FOR GOSUB GOTO IF/THEN/ELSE INKEY$ INPUT INT LEFT$ LEN LET LIST LLIST LOAD LOG MID$ NEW NEXT ON/GOSUB ON/GOTO OUT PAUSE PEEK POKE PRINT RANDOMIZE READ REM RESTORE RETURN RIGHT$ RND RUN SAVE SGN SIN SQR STOP STR$ TAB. TAN USR VAL VERIFY



and 80 column card.

A communications board is an expansion that will be necessary to run the CP/M disc system. This fits inside the original casing beneath the numeric keypad and will provide two completely independent RS-232 interfaces — running at up to 19,200 baud — with full handshaking and Modem communication lines, as well as the disc drive bus. This will allow RS-232 serial printers to be connected and Memotech has a networking system planned which will use it — the MTX Ring system.

Any ordinary cassette recorder can be connected to the MTX and the normal Save, Load and Verify allow the Saving to tape of various parts of memory. The default speed of the interface is 2400 baud, making it one of the fastest available. If necessary this can be reduced to make it more reliable by altering two of the system variables, but in practice the interface proved extremely tolerant. All programs Saved loaded without fault at 2400 baud from a cheap cassette recorder when the output volume was set at anything between 1 and 9.

Living up to its name, Memotech, memory is not something one is likely to be short of. The MTX-500 comes with 32K of RAM memory — the MTX-512 has 64K RAM — available for programs. An additional 16K RAM is dedicated to the video processor and thus the 32K RAM is nearly all available to the user even in high resoltuion, unlike the BBC computer. Further, if this quantity of memory should ever prove too restrictive it can be expanded internally up to a massive 512K. Up to two memory expansion boards which provide 32K, 64K, 128K or 256k can be added. The projected price of the 128K board is around £140 inclusive of VAT.

Unlike Sinclair, Memotech has opted to go for a standard VDP chip to drive the video display, the Texas Instruments TI-9929. This has four display modes: text — 40 characters by 24 lines; multicolour — unrestrictd 64 by 48 colour dot display, and Graphics I and II — 256 by 192 pixels. The latter allows increased colour information in each eight by eight graphics character pattern. Two unique colours may be specified for each byte of the eight making up the eight by eight pattern.

This effectively means that each horizontal line of pixels across the screen — of the 192 — may be a different colour of the 16 available — all 16 may be displayed at once — but the colour resolution in the other direction is not as high.

The colours available are: white, grey, black, light green, medium green, dark green, light yellow, dark yellow, light red, medium red, dark red, magenta, cyan, light blue, dark blue, and transparent. The latter is useful since it allows bleedthrough of the background colour.

Perhaps the most powerful feature of the graphics chip is that it allows up to 32 independently controllable sprite planes, plus pattern plane and backdrop plane, as well as the more usual user-definable characters.

Looking inside the MTX reveals that there are three 8K ROM chips providing a total 24K of ROM. This is larger than in any other common home micro with the exception of the BBC computer and its offspring, the Electron. Like these it incorporates an assembler, which will please Z-80 machine code programmers. It also contains a disassembler, a new language, Noddy, and an advanced Basic that includes some Logo-type commands. In addition, the ROM may be expanded to 72K via user-transparent paging through the cartridge port and a Pascal ROM — written by Hisoft — will be available.

Lives up to high-speed image

Advertisements for the MTX computer depict a sports car in the background and MTX Basic lives up to this "high speed" image. The results of the standard Benchmark speed tests are given in table 1. Memotech tells me that its MTX will run a Z-80B CPU with few modifications and the company may offer this as an addition — a Z-80B is similar to a Z-80A but it can run at higher speed, 6 MHz. This would increase its speed.

When the MTX-500 is first switched on text is displayed in white on a blue background. This was rock-steady on the colour television I tested it with — a Sharp — there was no colour "dot-crawl" with any colour combination. However, it was displaced by about one character too far to the left, making if very difficult to read the line numbers of a program. This could be corrected by adjusting the horizontal hold of the television, but then this had to be readjusted to allow the watching of television programs. Memotech is aware of the problem and is working on a solution.

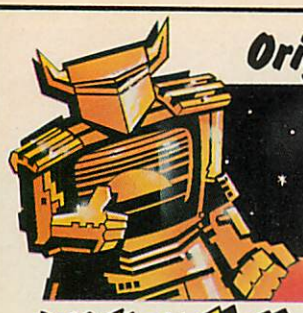
All Basic commands can be shortened to the first few significant letters followed by a full stop. As they are typed in they are printed in the bottom part of the screen and when Return is pressed their syntax is checked. At this point either an error message is printed with the cursor being positioned next the the incorrect entry, or the line is printed in a tidied-up form with command words being printed out in full.

This entry system works well in practise and the syntax checking on entry would be helpful to beginners. However, I did find it difficult to get used to the fact that in general spaces must be inserted between command words so that they are recognised as such. An unusual feature is the inclusion of an auto-entry facility which would be useful and timesaving when typing in long Basic programs. This

(continued on page 71)

Table 3. MTX Basic graphic commands.

CSR x,y	Position cursor.
CRVS n,t,x,y, w,h,s	Creates a virtual screen.
VS n	Calls a virtual screen.
PAPER n	Changes paper colour.
INK n	Changes ink colour.
COLOUR p,n	Set colour.
ATTR p,state	Switches attribute on or off.
PLOT x,y	Plots pixel.
LINE x,y,x',y'	Draws a line form x,y to x',y'
CIRCLE x,y,r	Draws circle with centre x,y and radius r.
AANGLE (x)	Sets absolute angle to x radians.
RANGLE (x)	Adds an angle of x radians to the current angle.
DRAW x	Draws a line of length x from the current plot position along a previously defined angle.
ARC x,theta	Draws an arc of length x turning through an angle theta.
CTLSPR p,x	Controls sprite parameters.
SPRITE n,pat, xp,yp,xs,ys, col	Creates sprite.
MVSPR p,n,d	Moves a sprite.
ADJSPR p,n,v	Alters previously defined sprite.
WINDOW dir, dist	Controls the position of the screen over the larger display matrix.
GENPAT p,n,8 bytes	Generates pixel character pattern.
SPK	Peeks the character at the current cursor position.
GREAD$ x,y,b	Reads bits directly off the screen.
DSI	Direct screen input. Allows the user to roam about freely within the screen ending when Return is pressed.



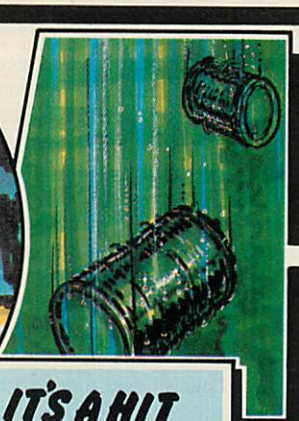
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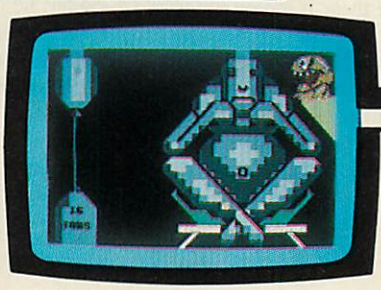


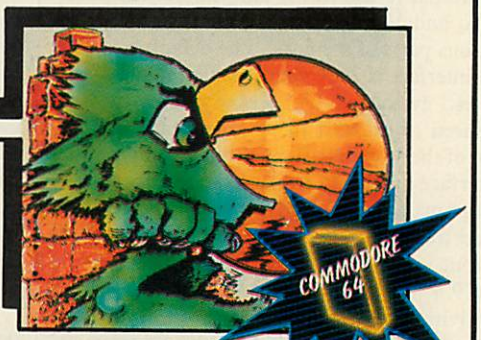


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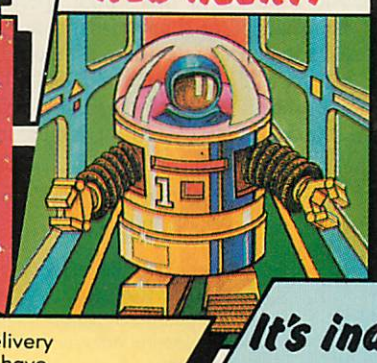


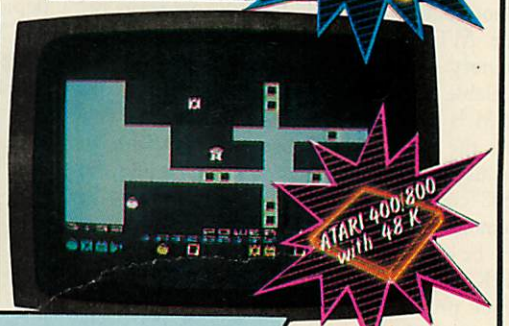






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(continued from page 69)
automatically places a new line number for the next line. For example,

AUTO 100,10

would start at line number 100 and then increment in units of 10.

Editing is via a straightforward and efficient line editing system. One simply enters

EDIT

or E. followed by the desired line number. The cursor keys then allow movement to any part of the line and characters can be altered and deleted. An insert key — toggle on-off — allows the insertion of extra material and another key — EOL — deletes to the end of the line. When all corrections have been made one simply presses Return and the line is stored in its new form. If an error is found when a Basic program is running the appropriate line is automatically brought down into the editor and the cursor is positioned accordingly. This speeds debugging — a nice feature.

MTX Basic contains all the usual commands — see table 2 — and has no serious restrictions. It also has the addition of many powerful non-standard graphics commands. These are outlined in table 3. One unusual feature is the Virtual Screen facility. This enables one to define sections of the screen — text or graphics — to work independantly as if they were the whole screen. One can create up to eight of these Virtual Screens with the CRVS command and switch between them with VS. Another command, DSI allows one to roam about freely within screen setting up a page of text using full-screen editing facilities. There are commands within this to change the Ink and Paper colours, switch the cursor on and off etc.

The sprites are supported by a number of special graphic commands which is in contrast to the Commodore 64 where you have to buy Simons Basic to get any. These sprite commands are powerful but fairly potential. For example, a sprite is created with the command SPRITE which has no less than seven arguments. Genpat — generate pattern — is then used several times to define its shape, and Ctlspr is used to define the speed, moving distance size, total sprite numbers etc.

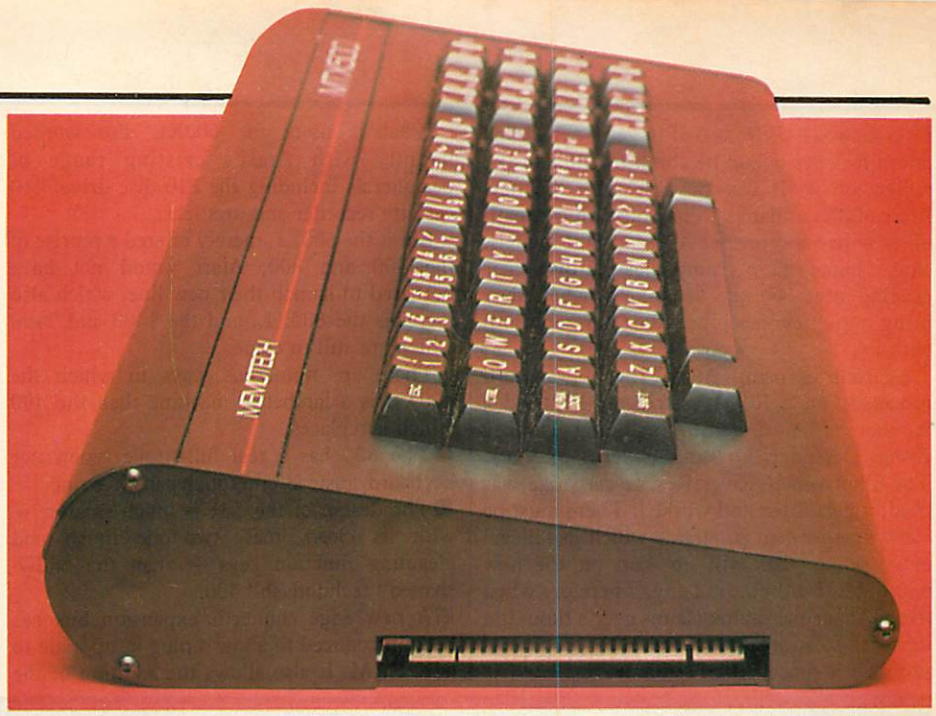
Some very good games are undoubtedly possible on the MTX and it is well suited to small business applications but Memotech has also incorporated several features to make it more attractive to the education market. The language Logo has recently recieved a fair amount of attention due to its Turtle Graphics which are claimed to be particularly suitable for teaching. Commands equivalant to some of these have been included in MTX Basic. Thus

DRAW x

draws a line of length x from the current plot

Table 4. Noddy commands.

I	INPUT	Wait for input from user.
D	DISPLAY	Display specified page on the screen.
R	RETURN	Go back to calling page.
E	EXIT	Return to Basic.
G	GOTO	Go to a specified page.
C	COMPARE	Compare user input with a particular key letter and if pressed then jump to a label.
P	PAUSE	Wait for a second.
O	OFF	Off.



position in direction angle which is similar to the Logo Foreward. Rangle — relative angle — changes the angle by theta radians and is similar to Left and Right.

These commands do not replace, but are an addition to, the more usual Plot, Line and Circle. However, it should be made clear that the MTX does not have a true implementation of the Logo language and I cannot help thinking that the command words chosen will be less readily understood by small children than the Logo Turtle commands.

Noddy is a new language that Memotech has designed to enable someone with very little programming knowledge to write their own interactive programs. There are only eight simple commands that need be mastered — table 4 — before some quite complex question and answer type program can be written. It is constructed in pages that incorporate text to be printed to the screen.

If a particular page is called the appropriate text is displayed and the computer then simply pauses or awaits a response from the user depending on the commands. Perhaps its most useful feature is its ability to automatically handle all text formatting. This is done using full-screen editing. One positions text on the screen using the cursor keys etc. in the exact way one wants it displayed when the program is Run. To call and use Noddy from within a Basic porogram one uses the Plod command.

Considerable thought and an appreciation of the problems of learning to program has gone into the design of Noddy.

The MTX also caters well for advanced programmers. Machine code is stored in special Code lines of Basic. to enter these one calls the built-in assembler with the command

ASS.n

where n is the line number where the machine code is required. Z-80 assembly language can then be entered directly and edited. Labels are supported and a listing can be directed to a printer. On completion one returns to Basic and the machine code is automatically linked for the area of memory it occupies.

Listing the Basic will show a Code line has been produced and the MTX will automatically disassemble the machine code in it. Whenever a Code line is encountered by the Basic interpreter it will automatically run the machine code contained within it. This makes it extremely easy to add machine-code routines to Basic programs.

To help debug machine code a Panel facility is provided. This shows the current value of the Z-80 registers and the contents of any area of memory. Memory can be stepped through, changed and its ASCII form examined. Breakpoints can be set and machine-code routines tested.

Sound is of great importance for use in games but on many microcomputers it is inadequate. Not so with the MTX, which uses a Texas sound chip having three independently programmable tone channels plus one noise channel. This is output through the television loudspeaker via the modulator and so can be as loud as you require. In addition a socket on the back is provided to enable connection to a hi-fi amplifier.

Sound is the main Basic sound command. It has a simplified form of three arguments that will allow the production of simple tones at various volume levels until they are switched off. Far more powerful is the full Sound command which has seven arguments. With this, frequency and/or volume can be increased or decreased with time enabling the formation of note envelopes.

CONCLUSIONS

- The MTX-500 is an impressive computer. It is well designed and very sturdily constructed. At £275 it is good value when one takes into account what it includes.
- It has a professional, quality keyboard. This and its elegant styling make it suitable for word processing and business use. The addition of the CP/M disc option would make it very powerful.
- The new language Noddy and the Logo type Turtle graphic commands will appeal particularly to the growing education market.
- It deserves to become popular with Z-80 machine code programmers who have been looking for a sophisticated machine.
- It is a true match for Acorn's BBC computer. ■

ATARI KEEPS

Jack Schofield puts the Atari 600XL through its paces.

IT IS ALMOST UNHEARD of to get a new home micro for review and be able to write half the review on it. It was possible with the new Atari 600XL, thanks to its software compatibility with the previous 400 and 800 models. Most home-micro companies throw their existing users on the scrap-heap when they bring out a new machine. Atari has kept faith with its.

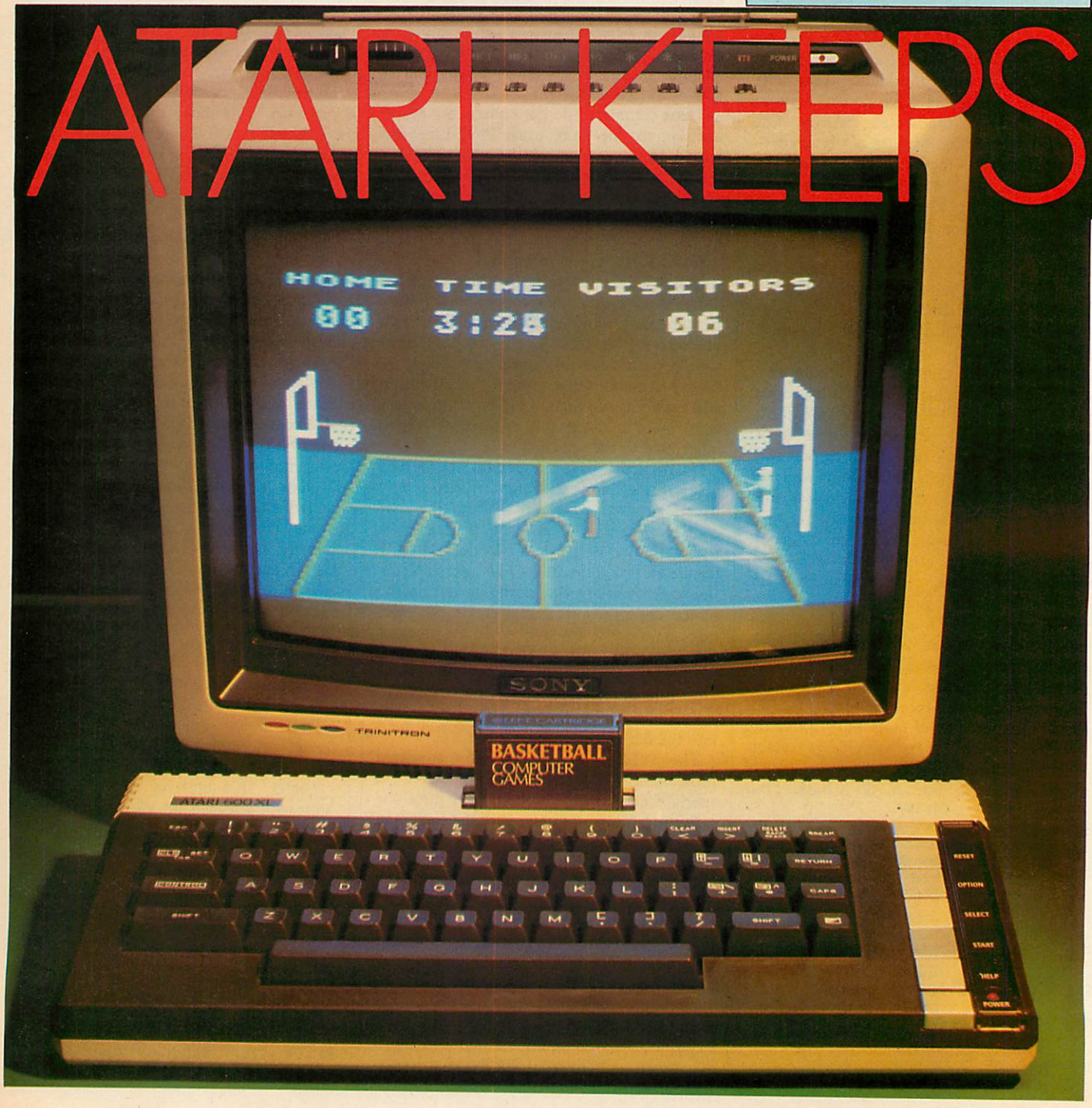
As well as using AtariWriter — a word processor on a ROM cartridge — I tried a number of Atari games including Donkey Kong, Defender, Qix and Caverns of Mars. The Thorn-EMI River Rescue cartridge was tried: it also fitted and worked. There must be some independent programs which use illegal entry points that will not run on the new micro, but I did not find any. Therefore when the 600XL's packaging claims over a thousand items of software are available for it, that is probably a conservative estimate.

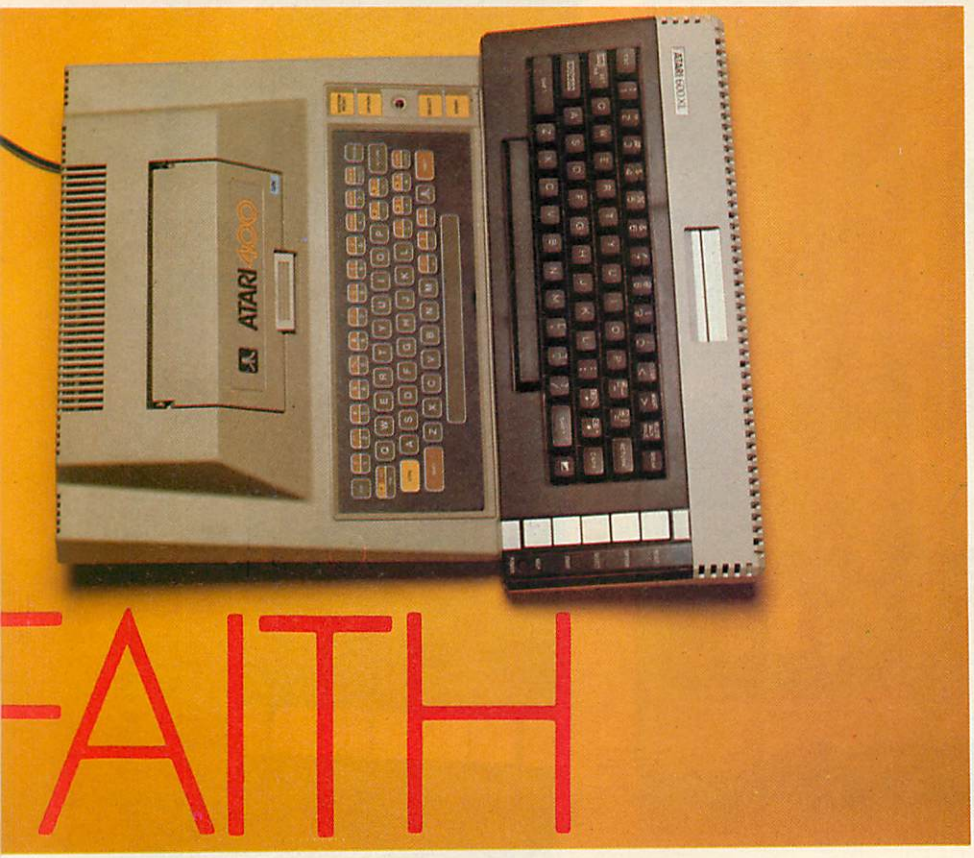
What is more the 600XL also worked happily with Atari's existing range of peripherals including the 810 disc drive, 410 cassette recorder and joysticks.

But if the 600XL merely offered a reprise of the 400 and 800, Atari would not have bothered to launch their new line, which also includes the 800XL, and the 1400 and 1450 which are still to come.

There are numerous ways in which the 600XL is a far better machine than the 400 which it replaces:

- The 600 has a real full-stroke typewriter keyboard, instead of a touch sensitive one.
- The design of the case is much smarter — with its clean lines, two-tone finish and gleaming function keys — than the oddly-shaped "technoflash" 400.
- A new edge connector/expansion bus has been introduced to allow a plug-in upgrade to 64K RAM. It also allows the addition of the expander box to provide other options such as a 128K ram-disc, hard disc, flat-screen TV interface, IBM PC add-on, IEEE-448 interface and a few other fancy gadgets.
- A composite video monitor output has been added alongside the PAL UHF output port on the back.
- A new Help key brings up a self test of the RAM, keyboard, four sound channels and graphics.
- A new 24K ROM includes the 10K operating system and the Basic which is now built in instead of being on a separate cartridge.
- The Basic has been further — and apparently completely — debugged.
- The addition of four new graphics modes





using the existing Antic custom chip and GTIA custom graphics chip.

In addition, the 600XL brings with it a new range of peripherals in the same two-tone black and grey style. These include the 1050 double-density disc drive with DOS3, 1010 dedicated cassette recorder — which now has two standard serial ports — Super Joysticks, Trak Ball, Touch Tablet, and three new printers.

One printer is the 1025 80-column dot-matrix; another is the 1020 four colour printer/plotter, which is like the Tandy/Oric/Sharp models. The third is a letter quality printer, the 1027. It may only do 20 characters per second, but it plugs straight into the 600XL, the print quality is outstanding, and it should cost only £299.

Peripherals to follow are a sophisticated light pen and an 80-column CP/M add-on, both of which I have seen running with an Atari 800.

Last but not least, Atari has redesigned the main board to make it smaller, cheaper and easier to manufacture than the 400. This has enabled the company to add the real keyboard and improve the design while remaining competitive on price.

Not much has been sacrificed from the 400. The rock solid aluminium interior casing has gone, to be replaced by tin sheeting folded over the main board. Also the 400's four 4-bit joystick ports have been reduced to two.

The Atari 600XL is a 16K home micro which uses the popular 6502C cpu with a clock speed of 1.79MHz. It also features three custom-designed chips called GTIA — graphics display — Pokey — sound generator — and Antic — graphics modes and screen I/O. These provide four channels of programmable sound, including distortion to control sound quality, plus 16 graphics modes.

The modes range from 40 characters by 24 lines of text to a maximum resolution of 320 by 192 pixels, which is close to the resolving power of the average TV receiver.

All but four of the graphics modes also allow a four-line text window on the screen. The maximum RAM used by any mode is 8K. Different graphics modes can be mixed on the screen at the same time.

Each mode brings with it a set of default colours, but these can be changed. A total of 256 colours are possible — 16 shades of 16 colours. Without machine code routines, 16 colours is the maximum you are likely to use at once, and they must then all have the same intensity. Another easy option is having 16 shades of the same colour.

Compared to the 400 and 800, the 600XL has four extra graphics modes numbered 12 to 15. Actually these already existed as Antic modes. The change is that they have been made readily accessible to Basic without complex machine-code programming.

In addition there are numerous other facilities including player-missile graphics, which is the Atari name for sprites, or you can have four sprites and four two-bit missiles. The character set is redefinable.

Sounds — including the keyboard click — are output through the TV monitor, so they can be as loud as this permits. The Atari cassette recorder is a stereo model with a sound track as well as a data track. As the cassette motor can be controlled from the console, this means speech and sound effects can be synchronised with programs and output through the TV.

This facility is used in some games such as Moonbase Io, and in educational programs such as Atari's Conversational language-learning series.

The Atari micros are well known for their sound and graphics capabilities and the 600XL comes up to scratch.

Atari has obviously taken to heart the rejection of the 400's keyboard: the one on the 600 is superb. The matt finish, the clarity of the labelling and the quality of the touch show a lot of thought has gone into the design.

In addition, Atari has corrected the solitary placing error of its previous models: the Atari logo key, which gives inverse video, has been moved to the other side of the right shift key. It no longer carries the Atari logo, but graphically declares its function.

There are 57 typewriter keys plus five brushed silver function keys including Help and Reset. A Caps key toggles the character set between upper and lower case. A Control key allows the set of 29 graphics characters to be entered directly, though these are not marked on the keyboard.

The Control key also allows four-way cursor movement through the excellent full-screen editor. Other keys include Esc, Tab and Break.

The shift keys are huge, and with the 16.5mm-long space bar make the 600XL a delight for touch-typing.

The rest of the case is plastic and very rigid round the outside, though slightly squashy in the middle. The old hinged lid has gone, and a couple of sprung metal lips protect the cartridge slot on the top. The two joystick ports have been moved to the right side of the console. All the other ports, plus an on/off switch, are on the back. A plastic cover protects the board's expansion bus.

Built into the case

The PAL circuitry is built into the case, though the power supply is external.

All round the 600XL displays a high standard of design and finish.

As it dates back to 1979, Atari Basic is by now quite a well known dialect. It offers rather better support for the hardware than Commodore Basic, but it is poor compared to BBC Basic. It has no structured commands. Mind you, it is only 8K, not a 16K Basic as on the BBC.

The advantages of Atari Basic are that it provides syntax checking on line entry and superb editing facilities. It also provides long, meaningful variable names, and some useful error trapping. As it offers string splitting rather than string arrays, maybe it will appeal to Sinclair ZX-81 and Spectrum owners looking for an upgrade.

There is no single key keyword entry, but there is a quick alternative: abbreviations can be used instead. For example, you can enter GR. for Graphics, SE. for Setcolor, DR. for Drawto, F. for For and N. for Next etc. Basic expands these when you list the program.

Graphics commands are Graphics, Setcolor, Color, Plot, Position, Locate and Drawto, which draws a line. The only sound command is Sound, which has four parameters to control the four separate voices. These govern the channel number, frequency, amount of distortion — for different sound qualities — and loudness.

Duration has to be controlled via delay loops. While the hardware produces nearly

(continued on next page)



(continued from previous page)

nine octaves if you Poke it, the Sound command offers 255 frequencies — only 3.5 octaves.

Other commands are pretty much as expected, including Read, Data and Restore, Paddle and Stick commands, the usual built-in functions, and Pop. Machine code routines can be called using USR. There are eight streams or channels which you can open and close to control I/O conveniently. Commands for Saving and Loading with tape and disc are plentiful.

The few bugs in the original Basic seem to have been cleared up. A naked Input no longer causes a lock up, and the unary minus works correctly. Dimensioning a string larger than memory now produces an error message. If there are still bugs in the Basic, I could not find them.

The 600XL runs the standard Benchmarks a tiny bit quicker than the 800. However, Atari Basic is still slow, and far too slow for action games unless you are a clever programmer or use machine code. Also the Basic does not offer commands to control the player-missile graphics. These are supported by other Basics such as Basic A+, Basic XL and Microsoft Basic, but they could only be used on ROM cartridges.

Other languages currently available for the 600XL are Pilot, a Macro-assembler and an assembler editor. I doubt whether the 600XL Basic could be used with any of the Basic compilers.

There are three alternatives in the form of three new language cartridges on the way:

■ Atari's Microsoft Basic is being issued on ROM as Microsoft Basic II.

■ There is an outtanding Atari Logo which I have toyed with, and which is nearly ready for release.

■ The original author of Atari Basic, Optimized Systems Software, has written a fast new games language called Action, which has just been released on ROM in the USA at $99 — $65 discount.

With the 64K upgrade, of course, a large number of languages become available, including several versions of Forth.

As has been mentioned, the 600XL is heir to a vast range of Atari and independent software. It has more games available than any other micro, including the Spectrum. It also runs most of the world's best computer games, including Star Raider, Eastern Front, Way Out, Zaxxon, Zork, Donkey Kong and most arcade favourites.

Mind you, they are mostly American and very, very expensive. Most of the best games either require a disc drive and the RAM expansion, or else you have to pay £24 to £30 for the ROM cartridge version.

The 600XL is potentially a great games machine, but buying software puts it way above Spectrum price levels.

There is a smattering of home finance and educational software available from Atari and third parties. The excellent Atari Home Filing Manager — a computerised card index — only requires 16K, and the AtariWriter word processor is a ROM cartridge so it runs on the 600XL. It should therefore be usable as a home machine, not just for games.

From the business point of view the 600XL does not have enough RAM for serious work. VisiCalc requires at least 48K, so that is out. Most of the other business software such as the Chipsoft accounting and ledger packages require discs and/or Microsoft Basic.

With DOS loaded, the 600XL leaves only 7.5K of program space, which is not enough for such applications. No doubt the serious user will not mind shelling out the extra £££ for the 64K Atari 800XL.

The documentation supplied with the review machine was sparse. There was a tiny Reference Guide to keywords "for experienced programmers", but the promised Owners' Manual was missing. Atari seems to be implying that as there are about 50 books available, you ought to go out and buy one. At least it recommends what is undoubtedly the best book about the Atari, *Your Atari Computer* by Poole, McNiff and Cook (Osborne/ McGraw Hill).

Considering the high quality of the documentation Atari supplies with its games this seems a very odd line to take. At any rate, better budget the £10.95 cost of *Your Atari Computer* in addition to your 600XL.

CONCLUSIONS

■ The Atari 600XL is a well-designed, thoroughly debugged machines with an outstanding specification at a reasonable price. It already has huge amounts of software and peripherals available.

■ The basic machine is expandable to 64K and Atari will offer an 80-column CP/M upgrade with a Z-80 running at 4MHz. It could thus grow into a business machine.

■ While the entry price is low, the 600XL is a luxury machine and will cost you many times its price in software and accessories.

■ So far Atari has not achieved the kind of market share in the UK which as a $2 billion corporation it enjoys in the rest of the world, but the 600XL could change that. ■

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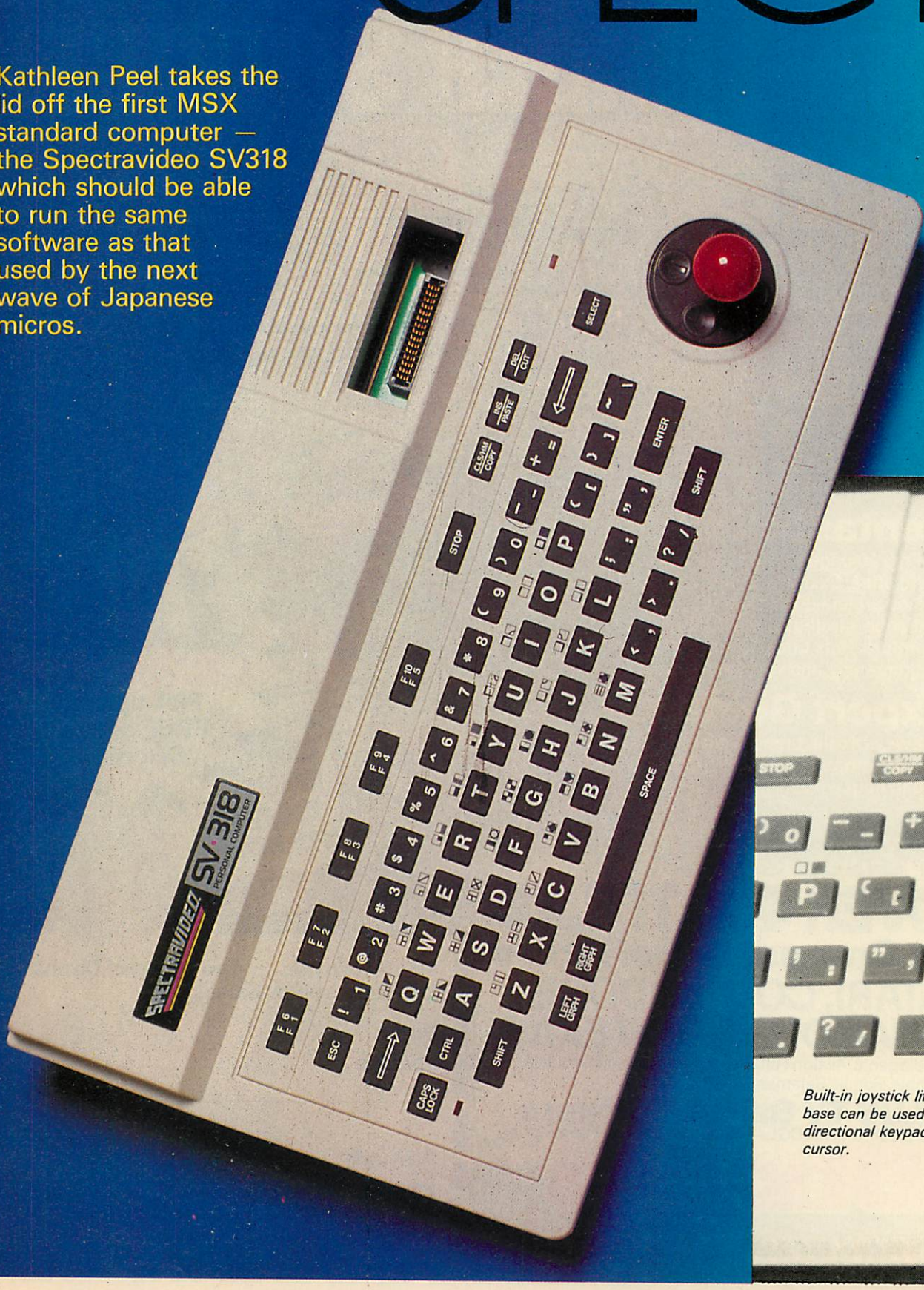
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SV318

SPECTR

Kathleen Peel takes the lid off the first MSX standard computer — the Spectravideo SV318 which should be able to run the same software as that used by the next wave of Japanese micros.



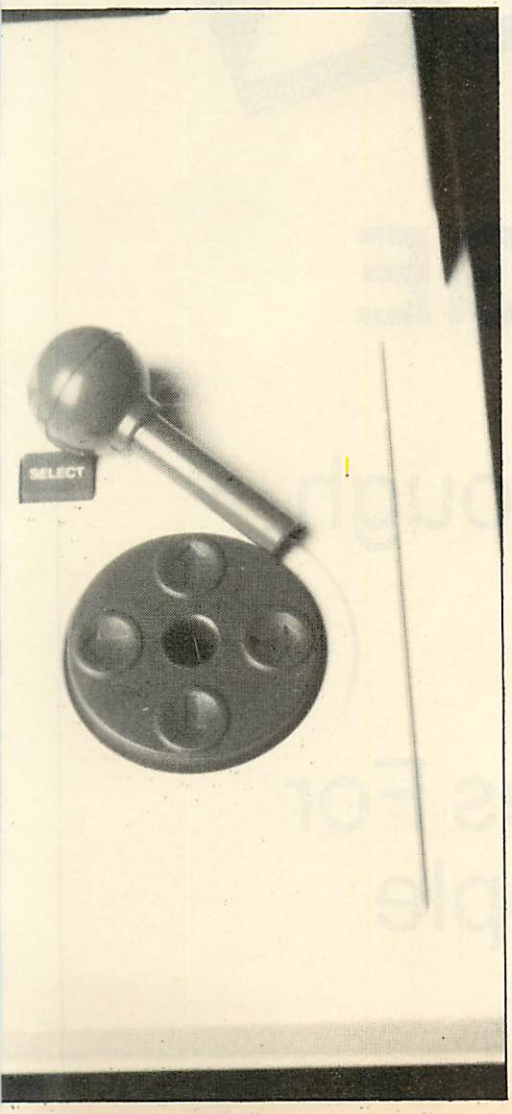
Built-in joystick lifts out so that base can be used as four-directional keypad to control cursor.

AVIDEO

THE REVIEW MODEL, ONE of the few MSX computers in this country, is a Spectravideo 318 and has been kindly loaned to me by Artic Computing which is at present translating the excellent Spectrum Chess II and selected other games from its range into MSX format.

The Spectravideo is not, in fact, a UK version, but an American machine that operates on the NTSC television system. There may be minor changes to the UK machines, but they are not expected to be significant if indeed the machine is to be sold in the UK.

MSX is the new Microsoft standard designed to bring compatibility to software in low-priced home personal computers. It is based on computers built around the Z-80A processor, the TMS-9918A video display processor and the AY-3-8910 programmable sound generator. A 32K ROM contains an enhanced version of Microsoft's Basic interpreter and there is a minimum requirement for 8K of user-RAM.



Companies supporting MSX beside Spectravideo include most of the major Japanese electronics companies who at present do not have a foot in the computing door in this country — Sony, Sanyo, Toshiba, Hitachi, to name but a few. If they are serious then the next few years in computing is going to be very interesting.

One thing the standard will do, if it takes off, is to allow new machines to be launched into a market where, as a great deal of software will aleady exist, the only edge will be price and styling.

Full-size keyboard

The full-size keyboard with space-bar is of the Spectrum moving-key type and is one of the best examples of its kind with a switchable key click audible through the television speaker. The joystick provides a rapid means of moving the cursor around the screen and can be operated as a touch pad when the central lever is removed, a nice touch.

The cassette interface is at either 1200 or 2400 BPS but was untested. Expansion is through a 50-way edge connector and power input is via a separate transformer unit which provides both a 14V and 8V a.c. supply. Error messages are given in full with the line number of the occurrence. The machine boasts a full screen editor which with the touch pad facility is extemely easy to use.

When running a program which stops because of an error in the Basic, pressing the F4 key brings the offending line onto the screen for correction.

At switch on, there are 12,816 bytes free on this 32K machine. 16K is allocated to the video display processor and the user has the other half. One of the more interesting facilities is the ability to work in integar, single precision and double precision numbers. The default is double precision and that must be useful for business application programs — see figure 1.

Run two programs at once

Another possibly useful facility is the ability to run two programs at the same time — banked program switching — when the optional memory expansion is installed. Quite how this would be used I am not sure as I would not have thought the machine suitable for multi-user applications.

The VDP is capable of displaying 16 colours in high-resolution mode and supporting 32 sprites. The sprites may be single or quad square entities with the capability of being located in different planes to enable one sprite to pass over another. There is a graphics macro language — GML — which looks to have interesting capabilities in three-dimensional movements. At 256 by 192 the pixel resolution is not high for the first of a new generation of computers, without expansion the text screen display is limited to 40 columns.

The programmable sound generator — PSG — operates separately from the main processor enabling background music to accompany the landing of your flying saucers. The PSG also has its own music macro language — MML. Unfortunately, not being musically oriented, I am not able to use the full potential of the facility but it looks quite good.

Two manuals supplied

The implementation of a joystick on the keyboard seems to be fashionable but of dubious value. Allowing the stick itself to be removed and leaving what is effectively an eight direction cursor pad is very neat.

Two manuals are supplied, the *SV318 Personal Computer Users Manual* and the *Basic Quick Reference Guide.* The manuals are retained in a three ring binder.

(continued on page 80)

```
 ARITHMETIC FUNCTIONS
ABS   ATN   COBL  CINT  COS   CSNG
EXP   FIX   FRE   INT   LOG   RND
SGN   SIN   SQR   TAN
The usual arithmetic operators are
implemented plus EQU and IMP.
 STRING FUNCTIONS
ASC   CHR$  FRE   HEX$  INKEY$
INSTR LEFT$ LEN   MID$ INPUT$
OCT$  RIGHT$ VAL  SPACE$ STR$ STRING$
 I/O & SPECIAL FUNCTIONS
CVI   CVS   CVD   ERL   ERR   INP
LPOS  MKI$  MKS$  MDK$  PEEK  POS
SPC   TAB   USR   VARPTR      ATN
```

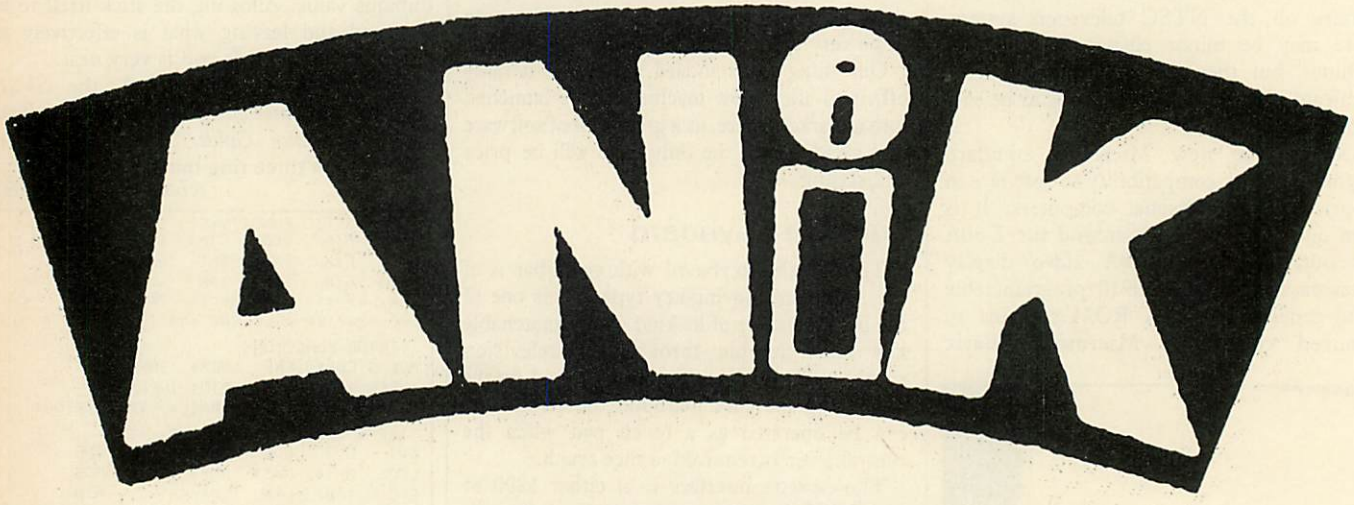
```
 BASIC COMMANDS
AUTO     BLOAD    BSAVE    CLEAR
CLOAD    COLOR    CONT     CSAVE
DELETE   KEY LIST LIST     LLIST
LOAD     MAXFILES MERGE    MOTOR
NEW      RENUM    RUN      SAVE
SOUND    SWITCH   SWITCH   STOP
TRON     TROFF    WIDTH

 BASIC STATEMENTS
BEEP     CLICK    DEF FN   DEF USR
DEFINT   DEFSTR   DEFSNG   DEFDBL
DIM      END      ERASE    ERROR
FOR      GOSUB    GOTO
IF-THEN-ELSE      IF-GOTO-ELSE
LET      MID$     NEXT     ON GOSUB
ON GOTO  OUT      POKE     REM
RESTORE  RETURN   STOP     SWAP
WAIT     SOUND    SWITCH

 GRAPHIC STATEMENTS
CLS      CIRCLE   COLOR    DRAW
GET      LINE     LOCATE   PAINT
POINT    PSET     PRESET   PUT
PUT SPRITE        SCREEN   SPRITE$
VPEEK    VPOKE

 INTERRUPT CONTROL
ON ERROR GOSUB
ON INTERVAL       ON KEY
ON STOP GOSUB     ON SPRITE GOSUB
ON STRIG GOSUB
INTERVAL          KEY      STOP
STRIG    SPRITE   on/off/stop
```

THE



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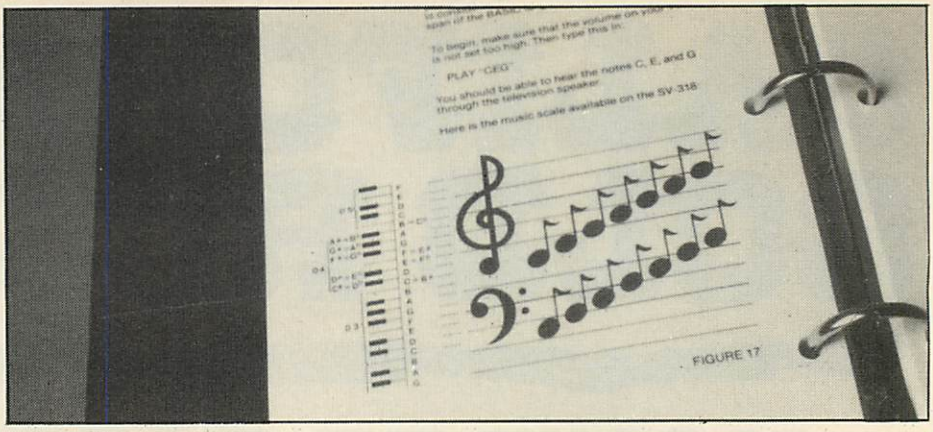
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Figure 1. One of the more interesting facilities of the Spectravideo 318 is its ability to operate in integer, single precision and the default of double precision, eminently suitable for business application programs. As a consequence of using double precision and storing numbers in 8 bytes, this program uses 8049 bytes for variable storage.

```
 2DIMB(1000)
 3FORA=1TO1000
 4B(1001-A)=A
 5NEXT
 6GOSUB20:PRINT
 7C=0
 8FORA=1TO99
 9IFB(A)>B(A+1)THENGOSUB30
10NEXT
11IFC<>0THENGOTO7
12GOSUB20
13STOP
20FORA=1TO100
21PRINTB(A);
22NEXT
23RETURN
30D=B(A)
31B(A)=B(A+1)
32B(A+1)=D
33C=1
34RETURN
```



(continued from page 77)

The user manual falls some way short of teaching the beginner how to use the machine but there is a tutorial tape which I have not seen and also a Basic Reference Guide and I assume that these items will complement the material in the manuals in that respect.

The memory maps in the manual interestingly defines Bank 2 as being reserved for CPM.

Prices.

SPECTRAVIDEO 318	£199
CASSETTES	£6
GAMES CARTRIDGES	£16
16K RAM	£29
64K RAM	£89
MINI EXPANDER	£12
7SLOT MOTHERBOARD	£99
DISC DRIVES	£199
SPECTRAVIDEO 328	£250

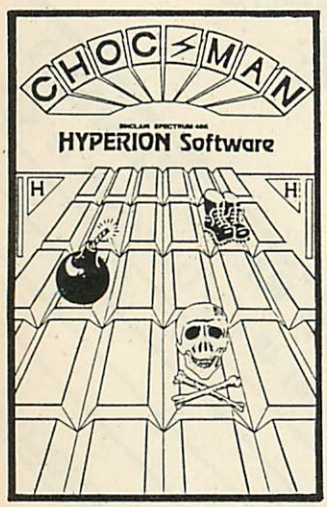
Real keyboard and 80K RAM.

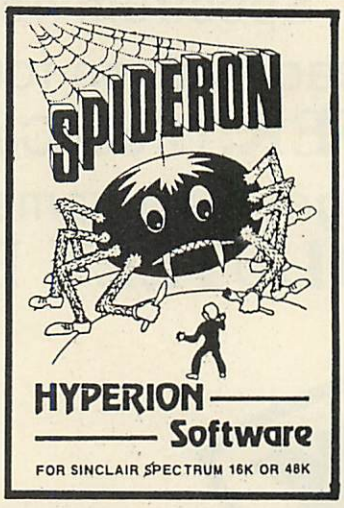
CONCLUSIONS

- In this short appraisal I have only highlighted the areas that seem to me to be of note. In doing so, much of the usual content of a review has been omitted.
- The machine is quick with some very useful sound and graphic capabilities. It costs about $300 in the United States which translates to £200 in the U.K.
- It could hold its own against all the current machines in that price bracket, but the new 8-bit machines may well cause it problems.
- Everything will depend upon the pricing levels adopted and how determined the MSX club is to penetrate the U.K. market. ■

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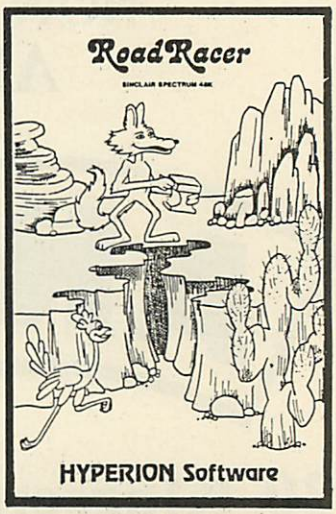
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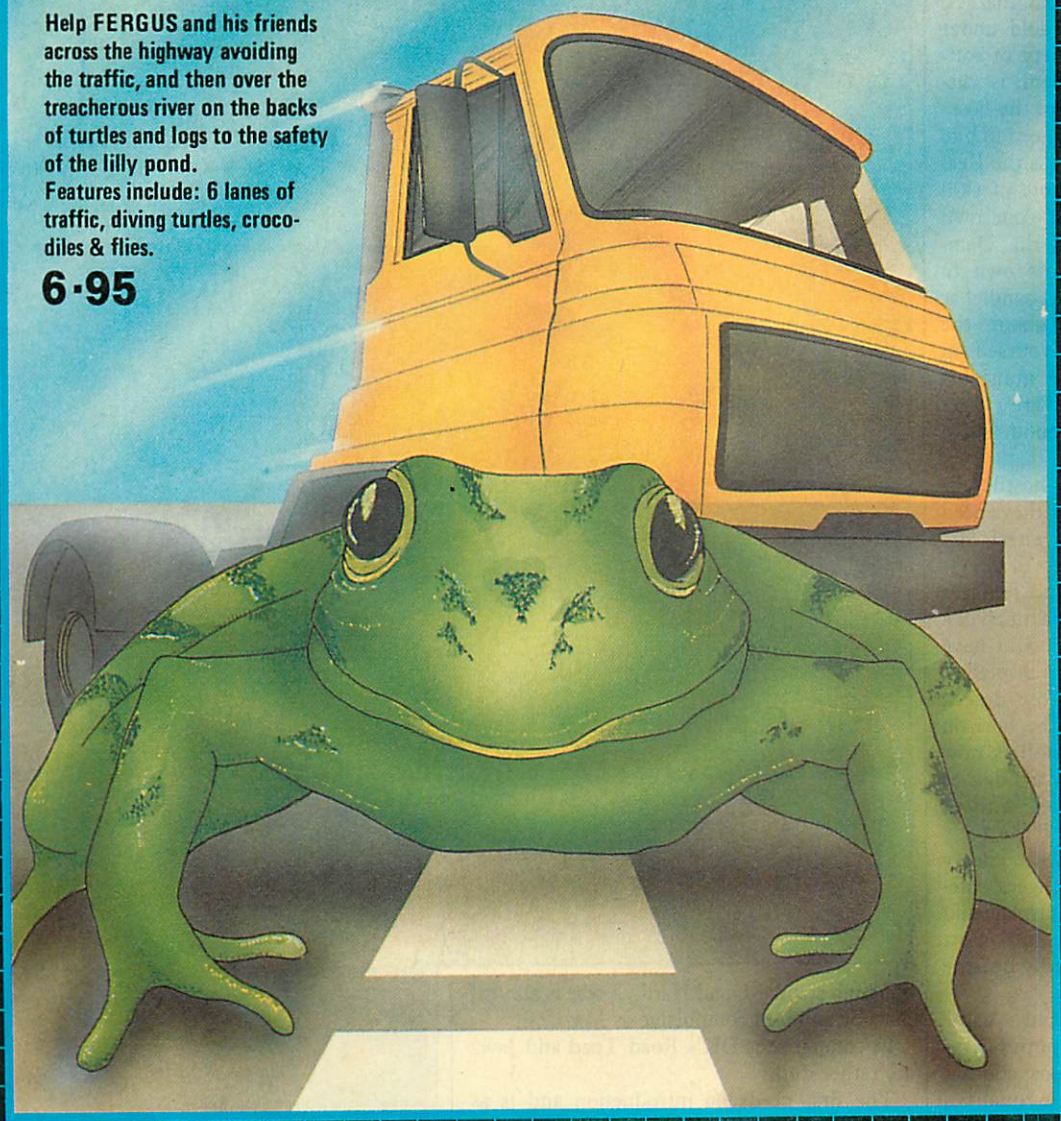
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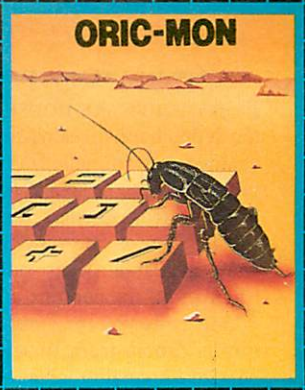
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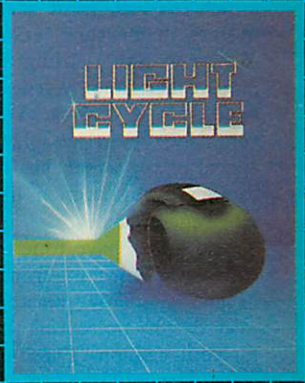
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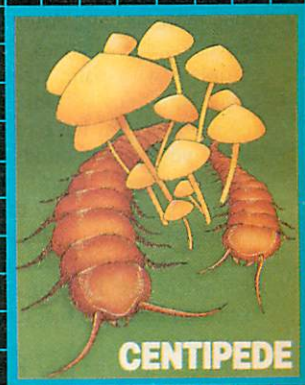
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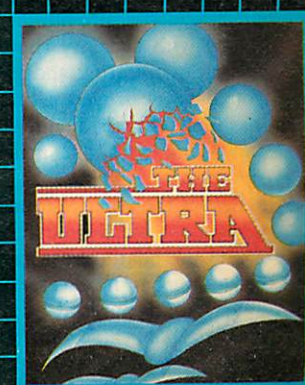












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EVERY SOFTWARE HOUSE, from the giants to the leprechauns, seems to have programmers chained to terminals, frantically churning out products for the massive Spectrum market. For Spectrum owners the pot of gold under the rainbow is the now huge variety of software available: their only problem is distinguishing the genuine article from the fake.

One game you certainly will not need to bite into is Zzoom from Imagine. This is the Real McCoy, a quality arcade-style game of skill and destruction in the comfort of your own armchair. The game starts with the Dambusters theme tune, enough on its own to make you start twirling imaginary handlebar moustaches and warn Ginger about the bandits at 4 o'clock. You find yourself in command of an aeroplane whose gunsights appear on the screen; also displayed are a dibar to show your relation to the ground and a long-range scanner.

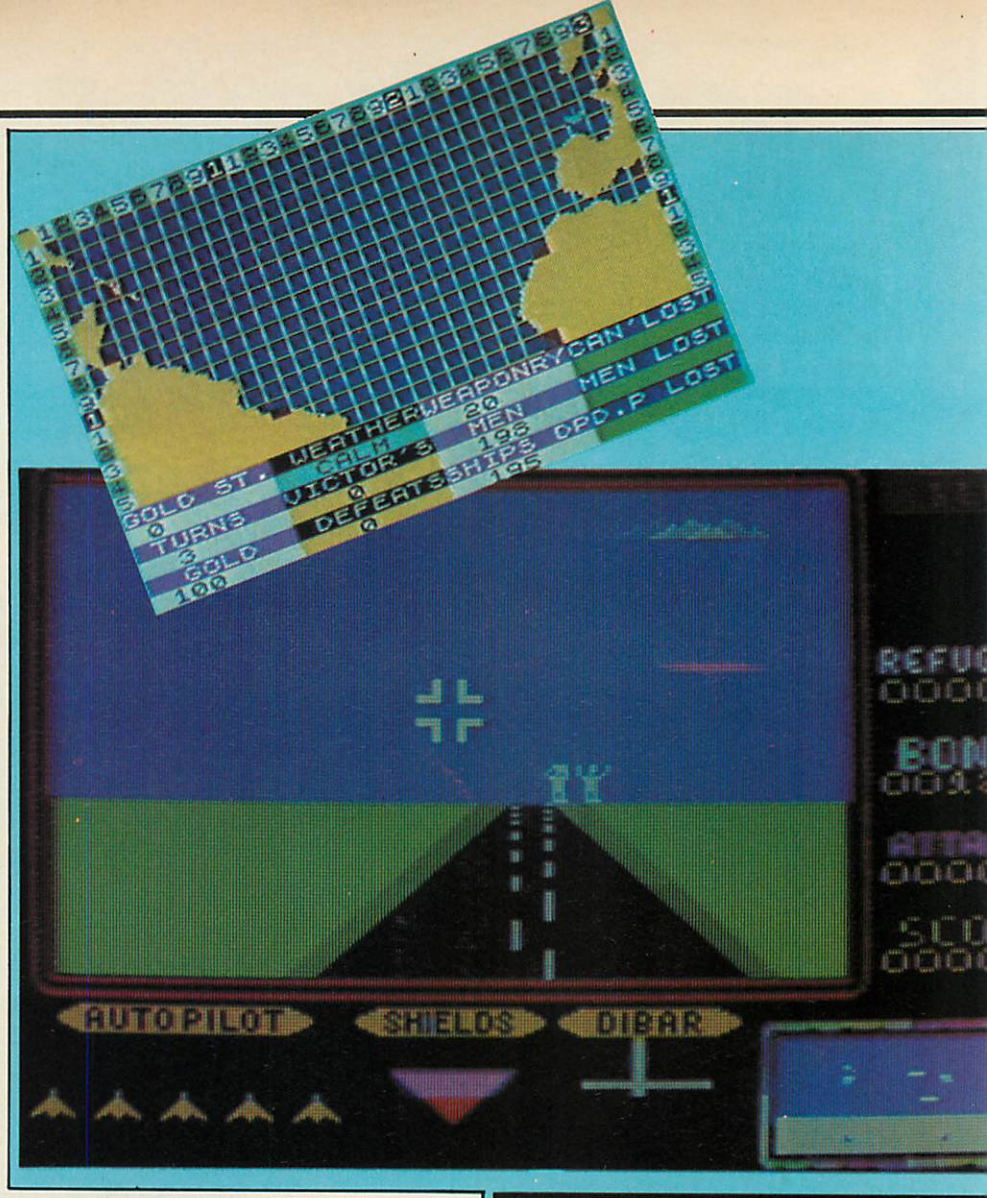
Before you have time to think, hostile aircraft are approaching from the east; they speed in and suddenly, unexpectedly, wheel 90° towards you, presenting the slightest of targets for your cannon. Those earthbound refugees you are trying to protect do not have much of a chance. Poor blighters, I wish I could have done more to help. After the waves of planes, the landscape changes. Now its the desert, complete with palm trees. Over the horizon come battalions of tanks. More skill is now required, as you have to dive low enough to shoot your earthbound adversaries without crashing to your doom.

After the desert — the sea, with enemy destroyers trying to blast the refugees' lifeboats. The standard of graphic display and excitement combine to make Zzoom a most exciting game, one that has deservedly become a micro-classic.

DK'tronics, though, has produced a game which could rival Zzoom's popularity. Maziacs may seem, initially, to be just another maze-game. In fact, it has subtle qualities which make it one of the best available in this genre. The scenario is familiar: you must get through the maze, collect the treasure and get out. You can ask the way from prisoners, and pick up swords to combat the maziacs.

What lifts Maziacs above the common land is its graphic sophistication. The monsters are the most grotesque I have ever seen on a micro; nightmarish squatting creatures, all legs and jaws who enjoy nothing more than gobbling you up. The prisoners are sad creatures, writhing in their shackles inside blue circles. One feels great pity for them but, sadly, one can do nothing to help. And you, the brave treasure-hunter, are a perky little fellow with a jaunty rhythmic step. You are never downhearted and your jubilation when you have destroyed a maziac is quite heartwarming. These qualities give Maziacs that something extra, and make it a very compulsive game.

Best of the other offerings from DK is Hard Cheese, in which you have to eat your way round the board, creating your own maze, in order to get at the cheese in the middle. Naturally, you are pursued by monsters. Naturally you can shoot these monsters, but this is not so easy as they move very quickly and you must replenish your energy. Again the graphics are of a high standard, and Hard Cheese is almost, but not quite, as compulsive as Maziacs.

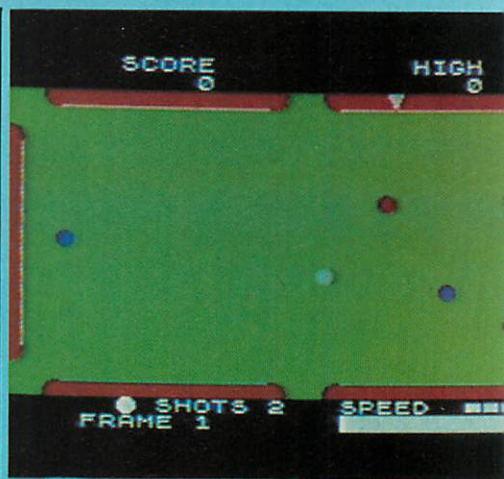


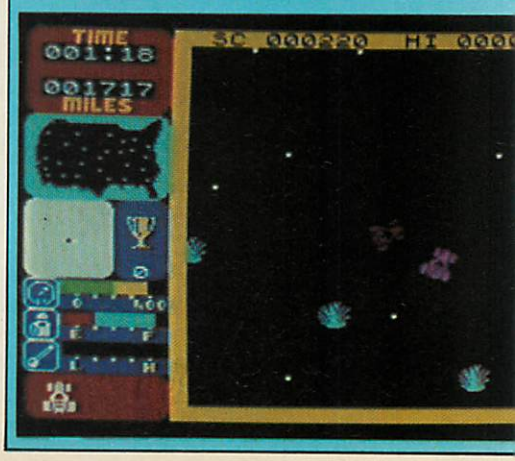
In comparison, DK's Road Toad and Jawz are rather dull.

The first needs no introduction and is as expected; though the graphics are, perhaps, a little clearer than usual, and the tankers are truly fearsome. Jawz is a disappointment; here you are underwater, firing at Sharks and Jellyfish. It is quite tricky to hit them as you have two cannons converging from either side of your control. Otherwise the game is low on interest.

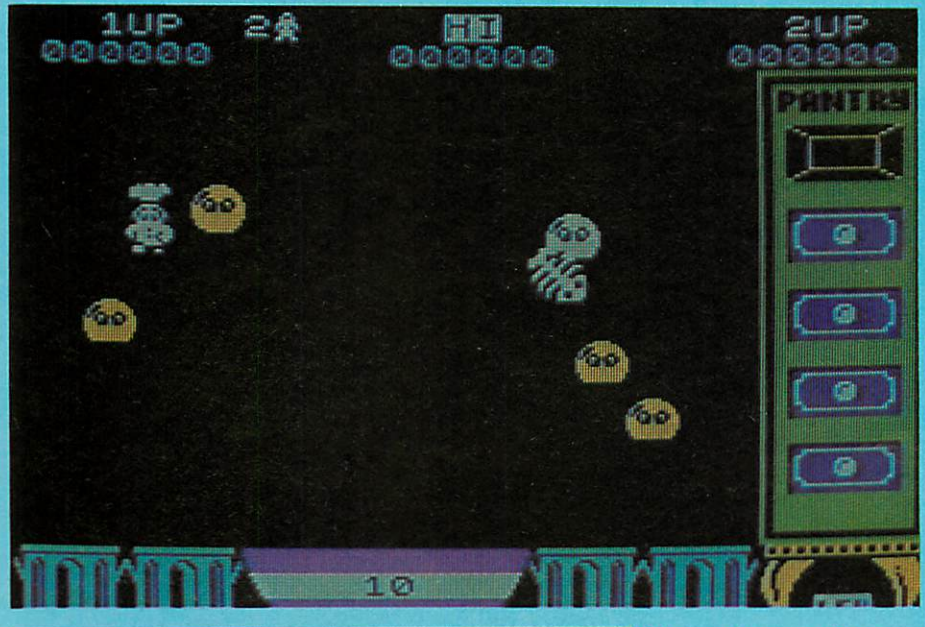
Ultimate Play the Game has a reputation for quality software, and it does not besmirch it with Cookie and Tranzam. Cookie has one of the wackiest situations for a long time; Charlie Chef's ingredients have escaped from the pantry-yard and he must recapture them by dazing them with flour bombs and knocking them into his mixing bowl. As well as the runaways Crafty Cheese and Colonel Custard there are nasties such as Wally Washer and Terry Tack. Crazy, but true. The graphics are very good and Charlie is a sympathetic little figure in his white chef's hat.

It is very difficult to avoid the nasties; if they get you, you end up in a dustbin. Cookie is a witty and enjoyable game, but one which you might do well to use a joystick for. Tranzam is set in the year 3474; it is your Red Racer verus the Deadly Black Turbos in the search for the Eight Great Cups of Ultimate. The screen displays a barren landscape where the only land-

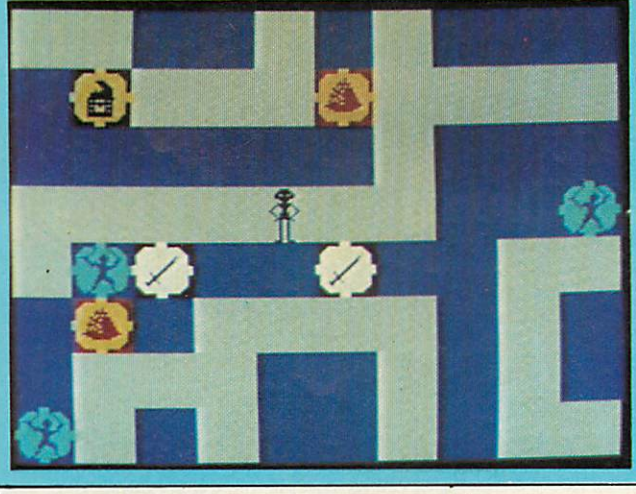




ZX SPECTRUM SOFTWARE







No other micro has the software back-up of Sinclair's Spectrum. Pete Connors ploughs his way through some of it from grappling with evil Maziacs to helping Charlie the Chef.

marks are cacti and petrol stations. You guide your car around looking for the cups, while trying to avoid your enemies and the obstacles. This is a tricky business if you are doing 400 mph and steering on the keyboard; again, a joystick would be useful. Tranzam is an exciting game which gives a taste of the Mad Max experience.

Game or blurb?

And so to Quicksilva. Do people buy their programs for the game or the blurb? Aquaplane's scenario begins "The contrasting blues of sea and sky provide a perfect backdrop as I relax with a Pernod and lemonade . . ." and goes on in the same vein for two sides of packaging. Indeed, Aquaplane's sea and sky are very blue, suggestive of hot Mediterranean summers. And, the game is very good. There you are, out for a bit of water-skiing, when the speedboat goes bananas. You are being pulled away to almost certain death.

Rocks, driftwood, tacking yachts, cruisers piloted by drunken playboys, snapping sharks; get through all those and you have mastered the game. Aquaplane is made more intriguing because, as the boat accelerates, you are pulled to one side or another, thus increasing the risk of meeting a sticky end on a piece of driftwood. The graphics, too, are very colourful and realistic. Aquaplane is a highly entertaining game — almost as good as the blurb.

On the subject of watery graves, Bug-Byte has Aquarius "an underwater espionage game". As commander of a frogman team you must destroy the bombs planted by an enemy nation. Problems you will encounter are sharks and electrifying jellyfish. Your oxygen will run out and must be replenished by collecting fresh tanks from the sea-floor. While the undersea world is fairly convincing and the sound effects are genuinely squelchy, Aquarius is not a very exciting game, lacking the speed and variety of top-class programmes.

Encounter with Dark One

In Styx, also from Bug-Byte, you are supposed to be battling your way across the mythological river to Hades "towards an encounter with the Dark One himself". In fact, it is a rather boring maze game, where the "deadly spiders" look like bits of dried grass and the Piranhas — did you know there were Piranhas in the Styx? — are most unconvincing. If they have micros in Hades as well they may well be playing Pool, another Bug-Byte game. The graphics are much better than Styx; a bright green for the baize and red for the balls. Curiously, the object balls are all the same colour. Control is straightforward, using the cursor keys.

But perhaps these denizens of Hades might prefer CHS Micro Systems' Pool. I know I do, if only because the object balls are divided into blue and red. Otherwise, it is much the same as Bug-Byte's version, easy to control and pleasant to look at. Both programs are for one or two players.

Purer pleasures of the mind are catered for by Artic's Chess Tutor. The novelty of this program is that it not only plays chess — at three levels — but takes the beginner through three different opening variations; King's Indian, Ruy Lopez and Sicilian Dragon. There is also a section which demonstrates the moves of each piece.

(continued on page 85)

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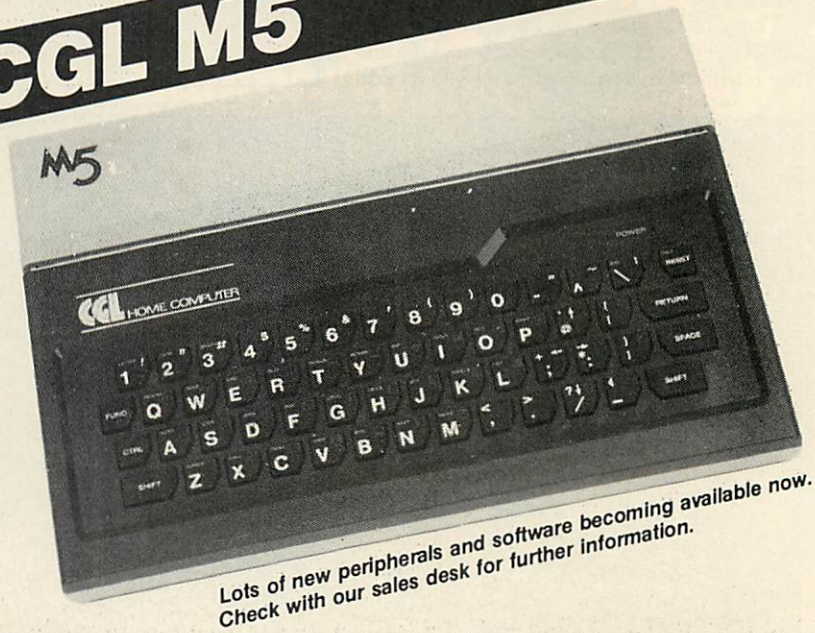
The Atari 800XL is unlikely to be available before Christmas, but is in any case no different from the 600 XL except all 64K RAM is built inside box.

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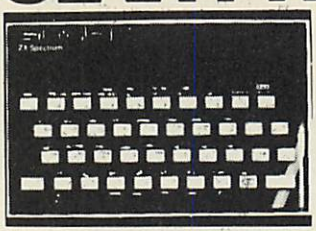
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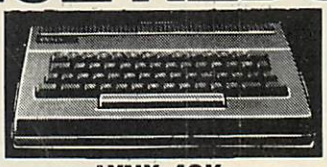
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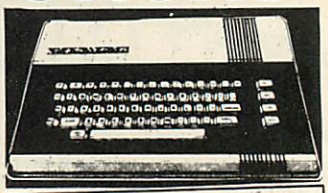
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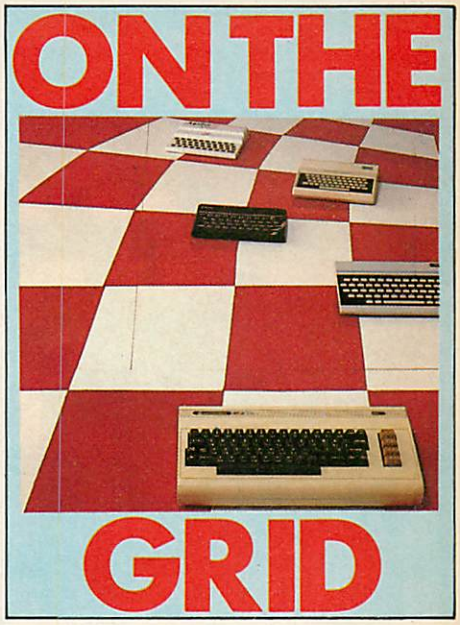
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YC11

SUB-£100 MICROS

This *Your Computer* survey provides a comparison of nine micro-computers costing less than £100 together with their peripherals.



THE RESPONSE to any computer is time-dependent — whereas initially the Spectrum was hailed as an outstanding buy based purely on cost and facilities: colour, sound, 16K RAM for considerably less than any comparable machine, that is clearly no longer the case. There are now many micros which can match its performance and cost about the same.

When competition joins the market, the criteria by which we judge changes immediately to software availablity; technical back-up; expandability and long-term viability etc. Thus what stood out as an important new cost per facility machine at launch must be appraised differently at a later date. The content of a review is similarly time-dependant besides being coloured to a very large extent by the reviewer's own taste and background.

Looking for minor flaws

Given a first-rate piece of equipment, we generally start looking for the minor flaws. It is technically more pleasing and tends to give the review a better balance. Unfortunately, the converse is also true; one can spend considerable time looking for good points in absolutely atrocious equipment. Consequently a comparison review is perhaps the best guide to selecting a computer.

There are no hard and fast rules regarding the applicablility of computers but the following is a general guideline:

A sub-£100 computer should not as yet be considered as a business machine. It is purely a games machine with the facility for learning a dialect of Basic — or Forth as in the case of the Ace. It does not matter whose Basic you learn as very few industrial programs are written in Basic and most games are in machine code, whether Z-80 or 6502 may be more relevant.

Also, having structures in the machines language does not necessarily mean the user will write structured programs, but not having them means he most certainly will not, again whether or not this is critical is debatable.

Besides the computer, the user requires at least two other items of hardware, a tape recorder and a television. Most problems arise from the fact that neither of these items is specifically designed for the job.

A discussion has therefore beed added on these items, pointing out some of the common problems encountered in their use, and giving some advice on how to get the best out of your system.

Each datasheet gives a brief summary of the capabilities of the computers and the following text explains the advantages and disadvantages of the way each manufacturer has implemented these facilities.

The meaning of some of the technical terms used is explained and we have tried to show how a reviewer would reach the majority of the decisions regarding a computer's performance.

The most easily recognisable difference between computers is the keyboard, this is either a proper keyboard — Vic-20, Texas TI-99/4A; a membrane touch-sensitive keyboard — ZX-81, or a half-way system of moving key keyboard where plastic or rubber keys are positioned over a membrane keyboard to give some of the characteristics of a real keyboard.

Obviously a proper keybord is best and is a real bonus for typists in keying in programs. Unlike most reviewers, the majority of users are not typists and so other features can affect more the speed of data entry.

Single key entry is the one that users either love or hate. The advantages are that if you consistently use the machine, then it is possible to enter programs extremely rapidly without spelling mistakes and, if the machine has a syntax checker, without syntax errors. The disadvantage is that irregular use leads one to spend too much time looking for the keyword.

Is expansion viable?

It is extremely difficult to judge whether or not expansion in terms of improving parts of a system in this price range is, in fact, viable with the present rate of computer development and falling prices of equipment.

Expansion by adding accessories such as printers, discs etc. should, if possible, be made with equipment that may be used in any new system that you might buy at a future date. This comment is really aimed at badge-engineered products which occassionally limit the usefulness of the perhipheral to just one machine. Accessories are expensive and it makes sense at least to think about their possible use in any future system you might own.

One often neglected point is that of size, not just of the machine but of a system when all the accessories are attached. In particular, a RAMpack if not upright can take up a fair amount of room, add on a printer interface and the neat lines of a micro can become very unorthodox. There is also the consideration of the wiring which tends to grow like spaghetti when all the accessories are hooked up through the expansion port.

The quality and reliability of computers has improved significantly but you still can find a faulty machine. Do take it back and keep taking it back until you are satisfied with the machine.

Sources of failure

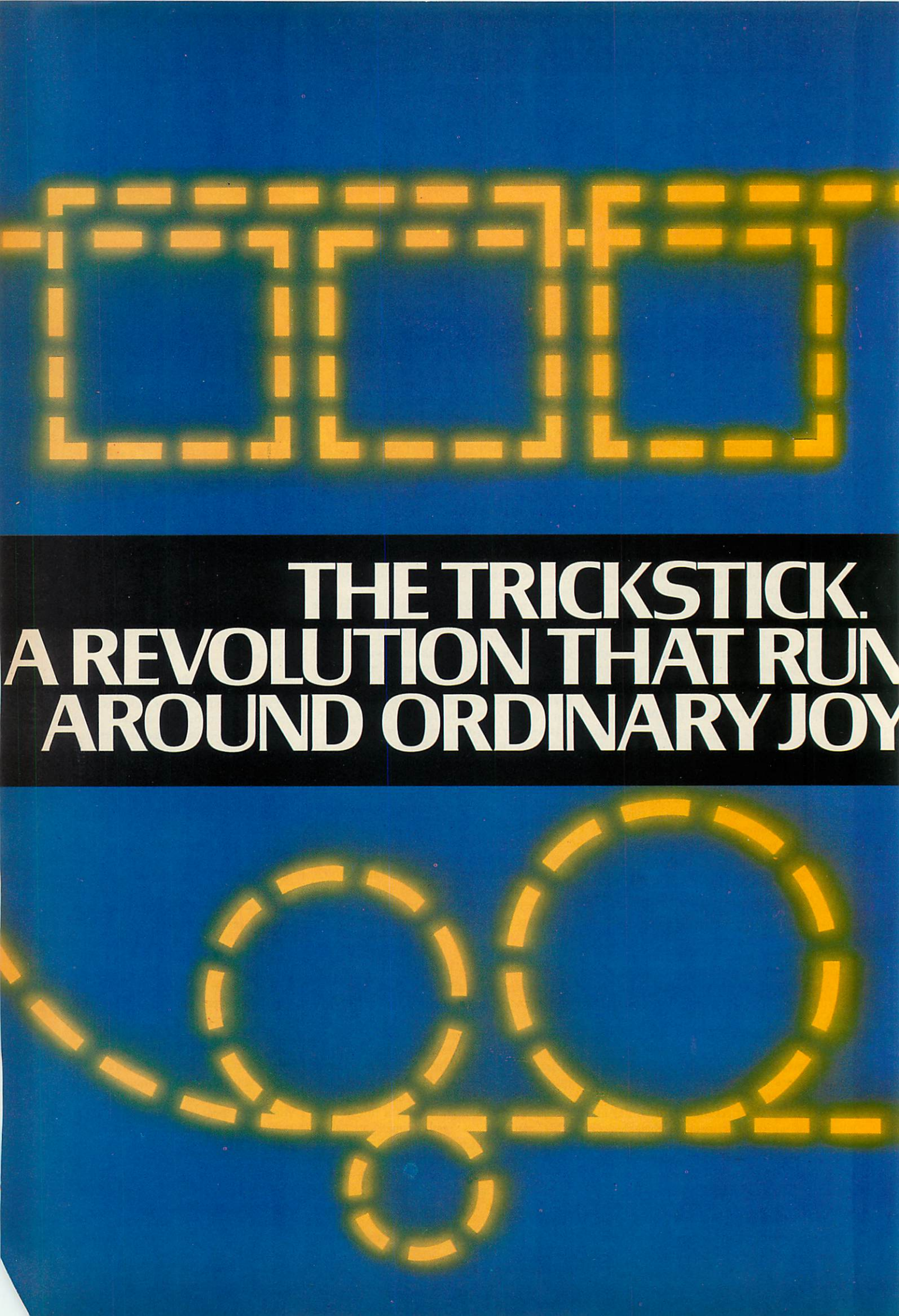
Faulty computers are not just those that have an immediately obvious fault when switched on; if your machine reguarly drops all your data after four hours of continuous use for no apparent reason it is a fault. Get it put right or have another machine. The other major source of failures is the power supply, some of these get incredibly hot and are barely suitable for their intended use.

Operating system: This generalised term covers the editor, cassette interface, television inferface, access to machine code and error messages.

There are three types of editor: line editor, where a line of text is put into a buffer at the bottom of the screen and edited; screen editor where the cursor keys are used to position the user within a program line on the screen and changes added or deleted in situ and, thirdly, the non-existent editor, in other words type the line in again.

If the maximum line length is limited to two lines, as it usually is, then to retype a line is very annoying. The line editor, if properly implemented, is good. Unfortunately, not all line editors are as good as the Spectrum's. Auto-key repeat is useful where line length is unlimited if cursor key control in the vertical plane is not available. The scren editor is best in so far as changes can be made on the screen within the context of several program lines. Unfortunately, the only implementation, on the laser, has a rather odd delete-to-right instead of the more usual delete-to-left.

(continued on page 93)


THE TRICKSTICK.
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(continued from page 89)

The reliable Saving and Loading of programs is one of the most important requirements. The section on program storage gives an overview of the problem and what steps to take if you do have difficulties.

Saving with a Verify function is useful. Verify checks that the Saved file is Saved without errors — these can occur with power supply noise when the washing machine or central heating etc., switch on and off. Fast loading is helpful as it can be tedious. Control for automatically loading data files can also be useful at times.

All systems have a television output and some systems allow alternative means of connecting to a display for better quality pictures. These interfaces are either through a composite signal — video — or an RGB signal input.

As a user, there may come a time when you wish to dabble in machine code. This, in effect, is programming the computer in numbers rather than English. Why? Well there are two important advantages to machine code — speed — up to 100 times faster — and space, usually very much more compact than Basic. The majority of articles of machine code running through the magazines are for either the Z-80 or 6502 processor, so it is an advantage if the computer uses one of these devices.

Error message on the screen

The original low-cost micros provided error codes — a number which, when looked up in an index, would provide the nature of the error. Lately, computers coming onto the market, place on the screen the actual error message or an abbrieviated form of it, a big improvement for fast program debugging. There is one feature here that needs explaining. In Sinclair Basic, as each line is entered it is checked for by syntax — are things in the right position and order? — and the line will not enter unless it is correct.

This is perhaps the biggest single advantage of the Sinclair machines over the competition for someone new to computing. In the majority of other machines an error message of syntax error occurs when the program is first Run which in most, but not all cases, specifies the line in which the error occurs.

There are two types of memory in a computer; RAM memory which can be written to and read from and ROM memory which can only be read. The ROM contains the computers operating system and languages interpreter.

Although a computer may have 16K or 32K or user RAM — about 16,000 or 32,000 storage spaces — they are not all available to you, the user. Somewhere the computer needs to store the screen display and system variables; in a colour computer the display can cause a very significant number of bytes reduction in the space available for a program.

To get around the problem, some computers have different pixel and colour resolutions — not every picture square is individually addressable for colour, normally a group of pixels is defined as one colour on and one colour off.

Another space-saving technique is the use of different modes, generally referred to as text and high resolution. Substantial space-saving are achieved in text mode which uses a display of say 40 by 25 characters and user-defined graphics or preset graphic characters to build up the display picture.

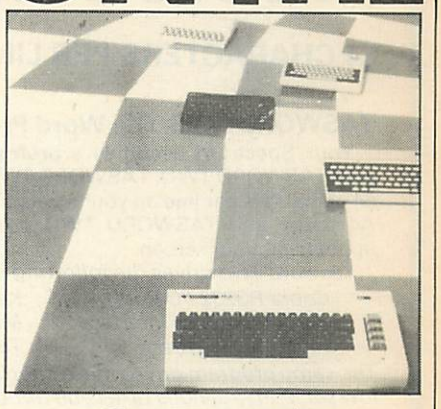
There are many dialects of Basic — the two main types in use on micros in the UK being Sinclair and Microsoft. There is an awful lot of rubbish spoken about which is standard, and, of course, the answer is neither, besides which it does not really matter. When you switch to main-frame or mini, although we are not sure why you would write in Basic on a main-frame, you will find many different dialects there: Hewlett Packard, DEC and IBM all use different variations — just accept it. Whether Microsoft's MSX is the answer for the micros we hope to report on soon but at present we have reservations.

Perhaps Digital Research may have it right but both are probably too late, next years batch of business machines will eventually take us beyond the 8-bit frontier.

What is important is the speed of the Basic implementation. The initial introduction to programming will be via a Basic program copied from the manual, developing from there to more adventurous magazine or book programs. If these are tortuously slow then the user can become very easily disillusioned. The only way out is via machine-code programming or the user just becoming a games player — nothing wrong with that, but there is a lot more to enjoy in computing once the user gets into the swing of things.

At least two of the machines get around this problem by having available a piece of

ON THE GRID



software called a compiler. This takes the Basic program and converts it into machine code format for the user. There are limitations as to what can actually be converted, but programs such as MCoder II for the Spectrum and ZX-81 are a tremendous help in this sometimes difficult area.

Some operating systems allow the single key entry of keywords, while others require the user to type all or part of the word, a few systems even allow both types of entry. There are pros and cons to each; the keyword thinking is that if all the words are on the keyboard, the user can see what can be used. It

(continued on page 95)

Cassette tape is the general medium used to store programs. All machines have a library of cassettes with pre-recorded games, teaching aids, utilities and most computers are provided with a demonstration tape. Other means of program storage are available — ROM, games cartridge — but are not so universally used.

To use a cassette tape as a storage media the computer records digital information on the tape. This process was, in the early days of ZX computing, a fairly slow process using music cassette tapes which were not really suitable. Since then, the technology of the tapes and the recording and replay process have improved tremendously and we now have very much more reliable systems.

In the search for better ways of solving the problem of data storage, all the manufacturers tried their own ideas in terms of data rates, levels and signal to mark ratios. Consequently none of the systems are compatible. Initially buy the best tapes possible to record your own programs.

Then, if cost is a factor, try less expensive tapes one at a time. Once you find a tape that suits your needs, stick with it and do not change unless it suddenly starts causing problems. Different makes and types of tape have differing dynamic ranges. Each will require its own playback level so it pays with a sensitive system not to keep switching from one make of tape to another.

The Philips Ferro C60 is reliable and, as a cheaper alternative, the Alpha plus cassettes from Woolworths. Always fast wind the tape forward and rewind before use, the tape can sometimes stick to itself causing problems when being used for the first time. Do not store the tapes anywhere near the television and most certainly never leave a cassette on top of the television or in bright sunlight.

The Vic-20 uses its own special cassette recorder for data storage but, in general, almost any tape recorder is suitable for most systems. The points to look for are as follows:

A tape counter is very useful — not essential, but close and, while on this point, always make a note on the cassette insert what you are Saving and where on the tape it is.

There are three recording methods: manual — adjust the level on a volume-type control to reach a predeterminised level indicated on the recorder's meter; peak clipping — similar to manual but signals limited to predetermined maximum, and automatic — where the general amplitude is raised or lowered to make best use of the dynamic range of the tape.

Most tape recorders were originally manual but in recent years the popularity of automatic recording has led to the virtual extinction of the manual type — which enabled recordings to be made with very low noise levels whereas the automatic variety tended to enhance the noise just prior to making a recording.

It is difficult to get a supplier to load a recorder to determine compatability with your computer, and computers are generally stated only to work with most recorders; unfortunate, if you pick a recorder that is not compatible.

(continued on page 95)

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(continued from page 93)
may take time to find each keyword, but regular use and familiarity will soon clear that problem. If the machine is used infrequently, then it is obviously easier to type each character separately.

Interestingly, a reviewer who sees many different machines would naturally be able to rapidly enter data into a non-keyword data system. Unfortunately this raises the syntax problem again as there are some Basic implementations which are very critical on spaces while others can be typed with or without and are tidied up for you by the operating system.

Graphics is a general term which is used to refer to the display for which there are five parameters:

Text display — the number of characters across and down the screen, the higher the number, the better the television display required. At 80 characters across including lower case letters, the television needs to be of monitor quality for adequtate reproduction, fortunately — or unfortunately depending upon your point of view — none of these machines produces more than 40 characters across without special software.

High resolution refers to the addressable pixel content of the display — a pixel being the minimum size block which can be turned on and off, this relates directly to the quality of graphics available. A space invaders game can get away with quite low high-resolution and still be acceptable but static circles and near horizontal lines do tend to show up inadequacies rather clearly.

Colour resolution — to save valuable RAM, high pixel resoltuion and low colour resolution is normally provided. This is not a problem with two colour displays or with displays which are sectionalised — built in blocks — but if you wish to produce the overlapping three circle patterns then this shortcoming becomes very evident. Another minor point is that of the border — there is always one and it is very useful to change colour to match the screen display. i.e., black for an invaders type game and green for a football or cricket pitch.

User-defined graphics enable the programmer to change some of the built-in characters to his or her own choice. This facility in text mode can be used to give the illusion of high resoltuion graphics while allowing the programmer to stay within the space confines of text displays.

A memory map is the file of user-accessible RAM in which the display data is located. It is usually in a fixed position and of fixed size into which the user can insert — Poke — information and read — Peek — data from the screen. In a colour computer another file — attributes — is required to provide the colour data. The attributes file may be positioned above or below the display file or become effectively interlaced with the display file to create what is termed "serial attributes".

In the field of graphics, and with sound for that matter, so much depends on the programming skill of the user; it is even possible to create high-resolution displays with the ZX-81 as demonstrated in the September issue program Sea Mines, or full screen displays for the Vic-20 as shown in the Astrogladiator program in the June issue.

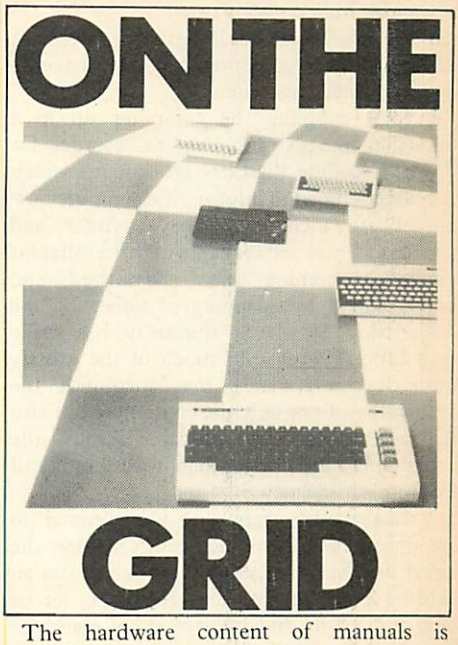
Sound facilities, where available, vary from the simple single channel to the General Instruments 8912 sound synthesiser with three sound and one noise channel.

Sound facilities available

The addition of sound to games, whether it be speech or a straight forward ping does add to the enjoyment and the sound synthesiser provides musical possibilities which are not available to single-channel machines.

The sound can be produced by a built-in beeper, a loudspeaker or better still through the television speaker which obviously provides an instant, and sometimes necessary, volume control.

The main task of manuals is to tell the user how to put the system together properly. They provide basic instruction in the use of the machine with lots of exercises, a couple of programs to type in and a smattering of technical information.



The hardware content of manuals is generally based on the absolute minimum of information, pictures showing in outline where each cable goes but not normally details such as the function of each pin or connector. to the user this information is of no consequence initially, but to a reviewer, whose only documention on the machine is probably the manual this information is needed to determine some of the less obvious expansion potentials of the machine and also the speed of reaction of the hardware add-on industry.

The remainder of the manual should take the user from the stage of initially switching on the machine through each command to providing the user with an understanding of the computer's language and a few examples in the art of programming.

It is here that the independant book suppliers, such as Interface notably with Tim Hartnell's series of books, provide the follow up to the manual with ready to type in programs.

Then, as the user-base spreads programs and articles start to appear in magazines on a

(continued on next page)

(continued from page 93)

Some computers seem to be able to work from just about anything, the Tandy MC-10 is an example; others are more particular. If you do need to buy one — do try and test it first with your set-up. If not, then the Superscope C-190 from Boots has worked with all the machines we have tested but it is expensive and many machines will work with virtually any tape recorder and tape with many years of trouble-free use.

Some of the more obvious sources of recorder problems are as follows:

■ If music which you record sound dull, lifeless and a bit wobbly when played back, you cannot expect the computer/cassette interface to work satisfactorily. Remember to clean the heads and tape-drive occassionally.

■ Avoid loops by unplugging the earphone lead when recording on battery supply rather than mains as this sometimes induces hum into the recording. Keep leads well away from the television and away from the mains cables — sometimes pick up can occur.

■ Keep the computer well away from the television.

We do not intend to discuss disc drives because they are quite expensive in comparison to these computers, but it is worth mentioning the Sinclair Microdrives and the expectation of several similar devices in the very near future for other computers.

These are an alternative to cassettes and provde very much faster access to programs and data. As yet they are not generally available but will start to appear in early 1984. Whether they will take over as the software media from cassettes is not really the question; it is just how soon and when will the competition between manufacturers remove the artificial pricing levels which has initially been employed to restrain demand in line with available production.

All the computers in this range use an ordinary domestic television as the display media. Although many users do buy a small portable colour TV to go with their new computer, most will use the family colour TV when it is not in general use. There will come a time when this will need replacing and it is just as well to look for compatability with your computer in its replacement.

As a guideline to the performance of an existing set for colour use, look at the colour registration of the broadcast teletext data in the display. If there is colour separation then you can not expect crisp clear pictures from a computer.

The new range of televisions now becoming available have inputs suitable for video recorders. These inputs are also available from some of the computers and can produce a very significant improvement in colour performance.

The composite — video signal from the computer is taken prior to the modulator and is input to the television after the tuning circuits. This method cuts out a great deal of interference and distortion and produces pictures of significantly better quality.

Some computers go even further and produce RGB signals suitable for monitors and even greater clarity, but that is possibly overkill in this price range.

It is interesting to see the new television from Philips with the printer attached. This at present dumps teletext pages onto the printer but unfortunately gets the information from the teletext decoder module and so, for the moment, is unsuitable for copying screen displays. ■

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more regular basis and, if sufficient sales have taken place, the computer may even have its own dedicated magazine.

Beyond coupling the computer up to a television and using a cassette recorder for program loading there are other items which can be purchased to improve the computer set-up. These include memory, printer and joysticks. These are available in three different categories: coming soon, advertised and available. All the slapping of wrists by the Advertising Standards Authority has made very little difference to much of the grossly misleading advertising that surrounds the availability of not only the computers but also the accessories and software. Again, the situation is a little better than it was but is still far from satisfactory.

It is extremely rare that a newcomer to computing would immediately require the larger memory machines other than to run an existing piece of software. However, let us omit the ZX-81 and perhaps those machines with less than 4K of available user-memory from this. To learn computing and mess around with Basic can quite easily be accomplished within 8K to 16K.

The problem is that no matter what thoughts the user had in mind to start with, there will always be that one game-utility that is essential, which unfortunately only runs on the larger memory machines. For this reason it is important that additional memory is realistically priced and that is not always the case.

One can usually obtain an alternative to the official item from the independent hardware sector — sooner and cheaper, but I am afraid not always with the expected reliability — also look out for loss of guarantee if the addition is required internally.

A review of printers is planned for the December issue but, briefly, of the many uses for printers — word processing and program development are the two main functions.

The prices of printers are beginning to fall and it is now possible to get a quality printer for under £100. These prices will continue to fall as the new printer techniques are used to attack the growing mass market-developed by the lower prices.

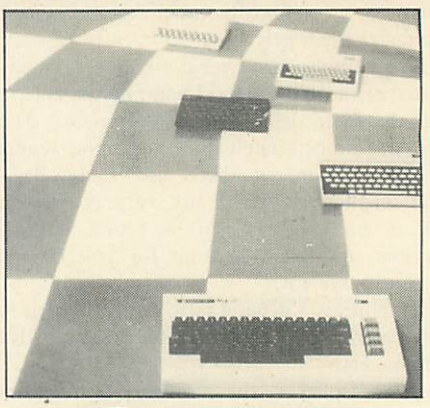
The joystick can, when integrated into an arcade-type game, make a tremendous difference to the playing quality. Control via a joystick gives a much better feel than through the more generally used cursor keys. A definite Christmas present for the computer enthusiast.

Don't forget mains plug

Finally, not all computers come complete and ready to go. Do not forget the little things like a mains plug. You will not be able to nip out Christmas day and buy one. Some computers do not provide cassette leads — check, if you are giving a present, that it really is complete.

Generally, we would still go for the Sinclair Spectrum as the best value on the basis of the available software at reasonable prices. The Microdrive makes an enormous difference to those of use who have been lucky enough to obtain one.

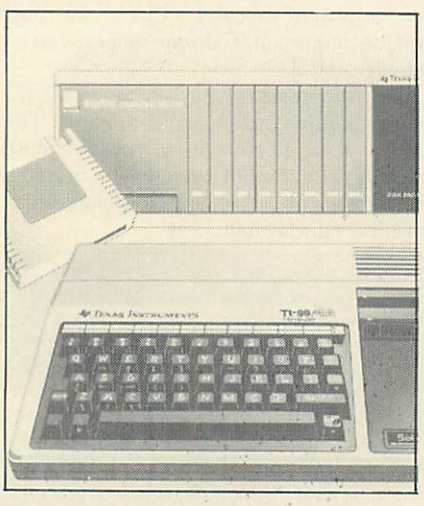
ON THE GRID



The Texas TI-99/4A at under £100 presents the best hardware value, but the machine just does not have the software or user-base which is a great pity. Its accessories also appear expensive when compared to the basic computer price and the documentation is poor. The Vic-20 is much closer to the Sinclair Spectrum in terms of value now that its price has dropped to less than £100. Indeed, if it was not for the Commodore 64 and the rumours regarding the demise of the Vic — unconfirmed we might add — this computer would probably be considered on a par with the Spectrum. ■

TEXAS TI-99/4A

Cost	£100
Keyboard	Real keyboard Auto-repeat 48 keys
Expansion	Edge connector Joystick port Cartridge
Size	15" × 10" × 2½"
Construction	High quality
Editor	Line editor (Good)
Line length	— Single statement lines
Cassette I/F	450 baud (Average)
TV I/F	Domestic TV Separate modulator
M/C access	Not available
Error messages	Full
Language	Basic
ROM	26K
RAM	16K
Processor	TMS-9900 (16 bit)
Graphics	TMS-9929A
Sound	TMS-9919
Pixel res	256 by 192
Colour res	32 by 24
Colours	16
Graphics UDG	User-defined



Sounds	Three tones plus noise
Manuals	Two: Read this first User Reference Guide (Poor)
Accessories:	£9 cassette cable £43 speech synthesiser thermal printer

CONCLUSIONS:

- **For:** The best value for money interms of hardware content. Makes the BBC computer look loosely packed.
- **Against:** Poor documentation, restricted access to machine-code programming. Very slow Basic on screen routines. Little published data in magazines. Small user base.
- A lot of computer for your money.

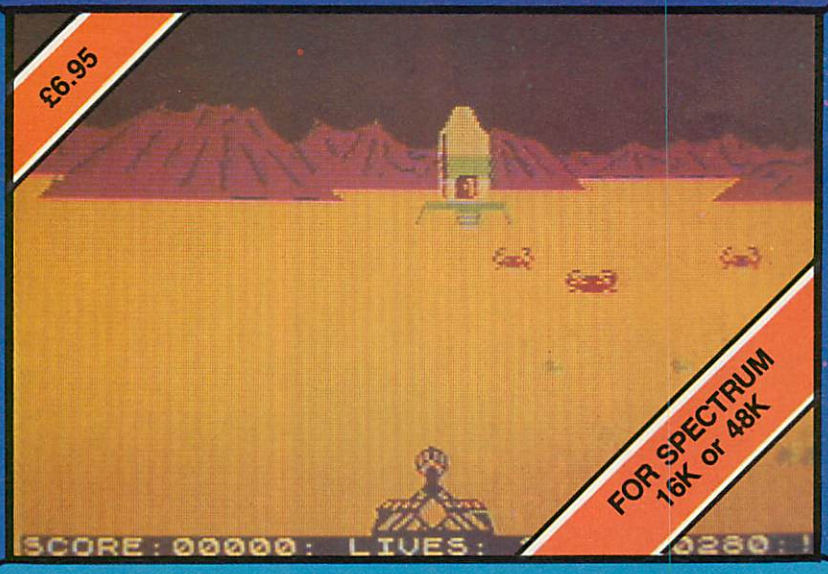
VIC-20



Cost	£100
Keyboard	Real — 66 keys
Expansion	Cartridge port Four peripheral ports
Size	16" × 8½" × 3"
Construction	Good
Editor	Line (Good)
Line length	Four Multiple statements
Cassette I/F	300 baud (Good but slow)
TV I/F	Domestic TV
M/C access	Peek, Poke, USR
Error messages	Full

(continued on page 101)

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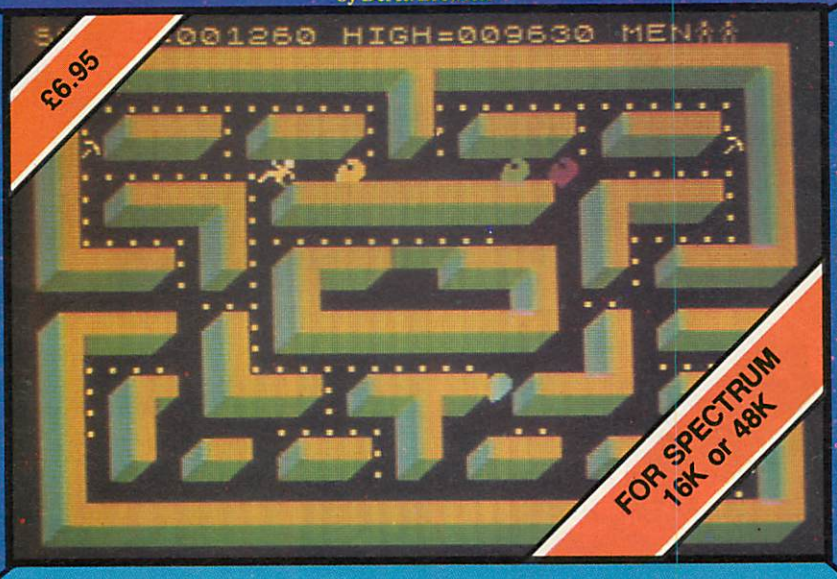
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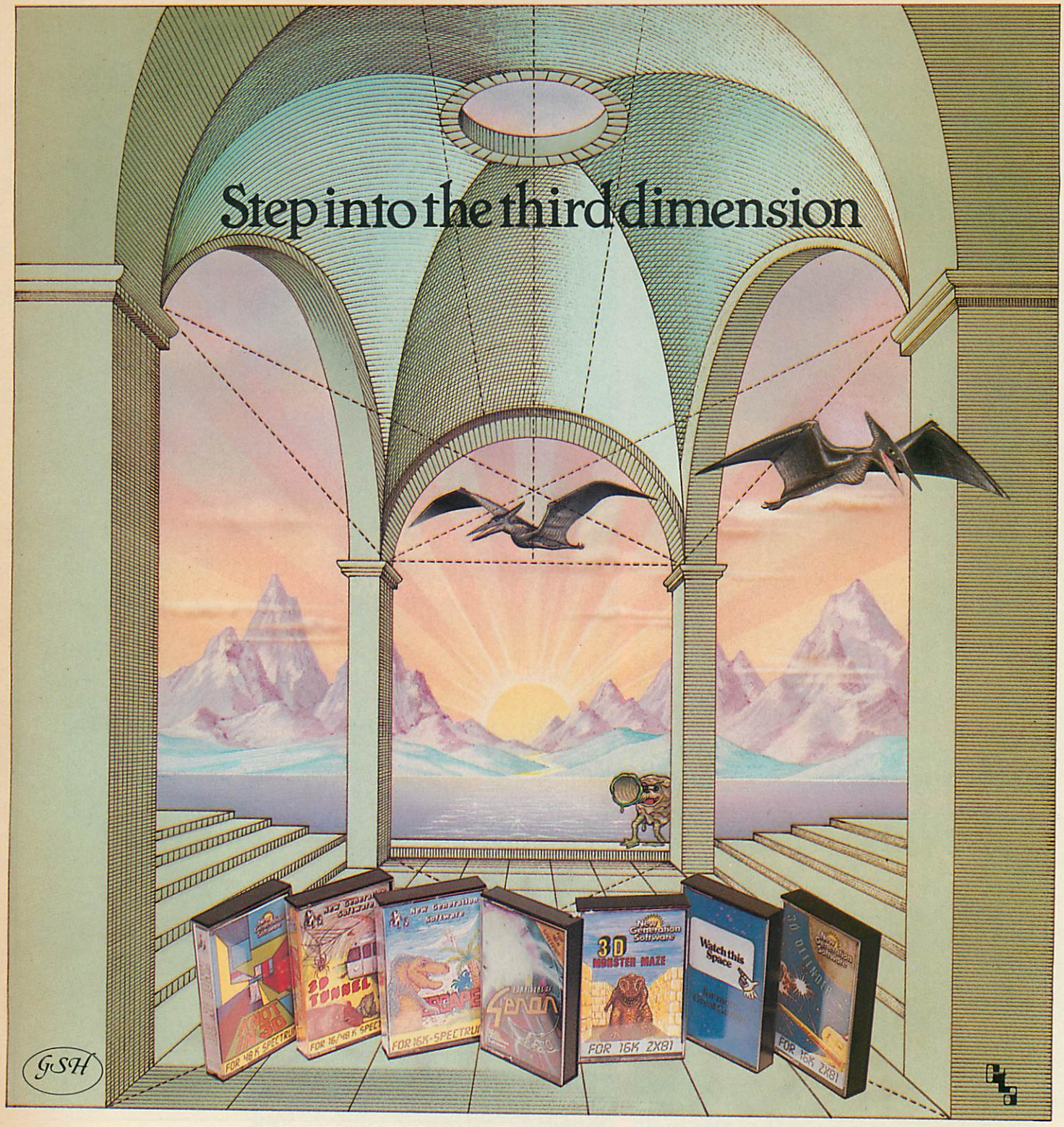
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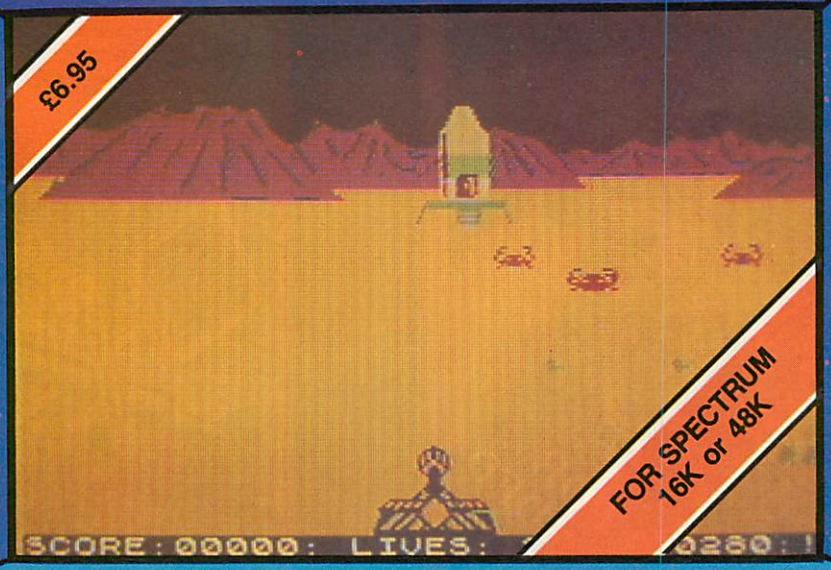
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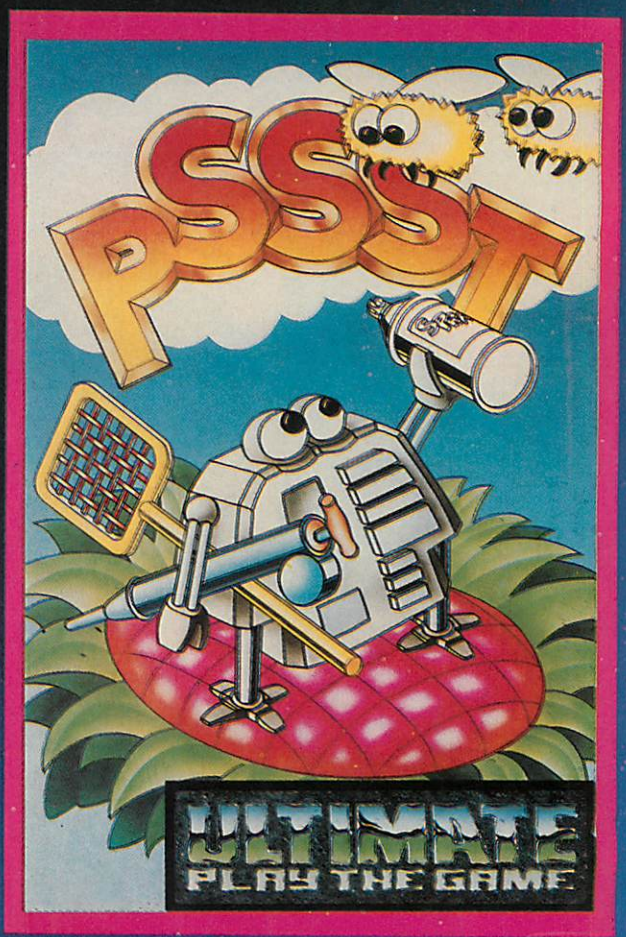
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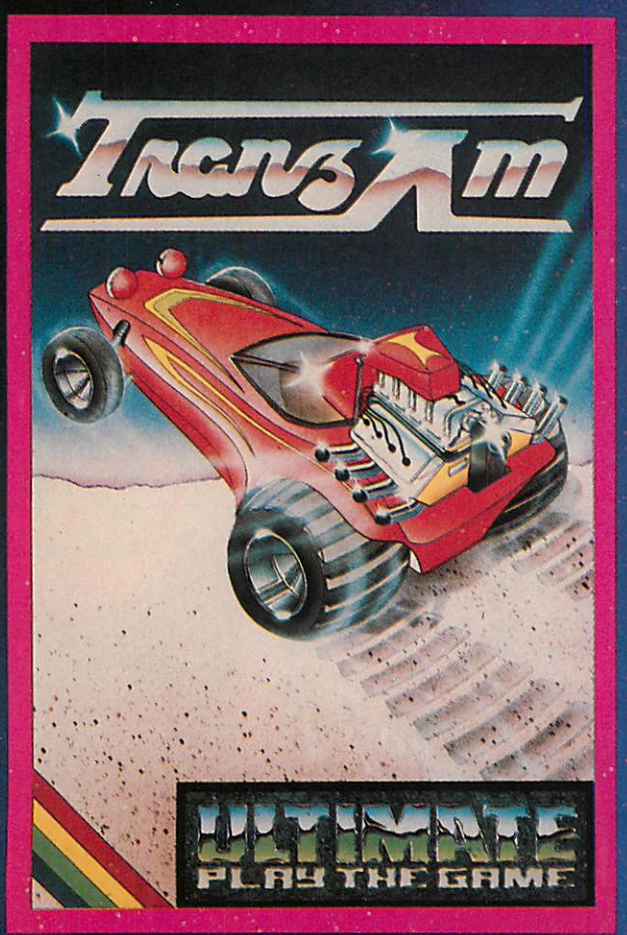
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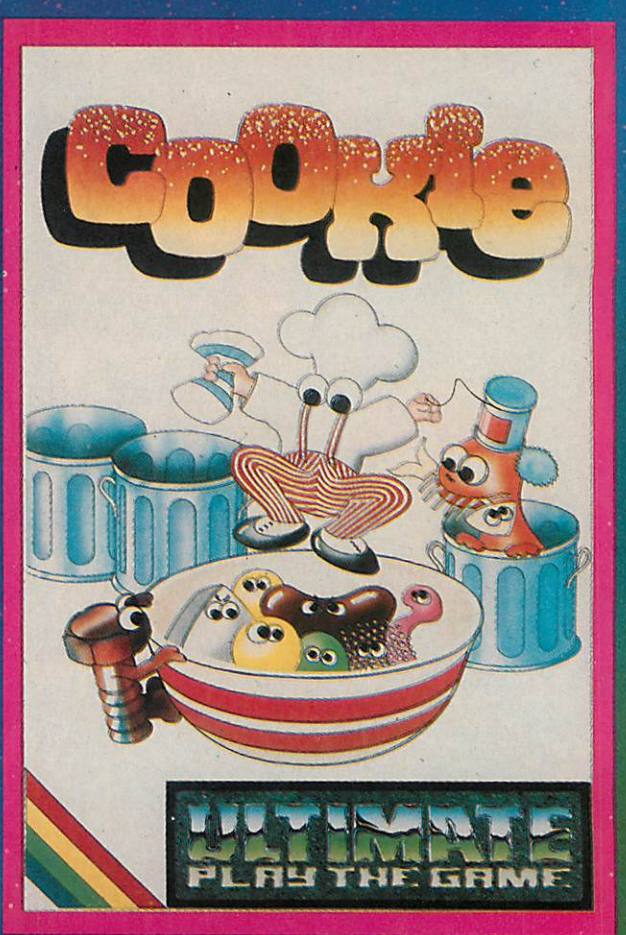


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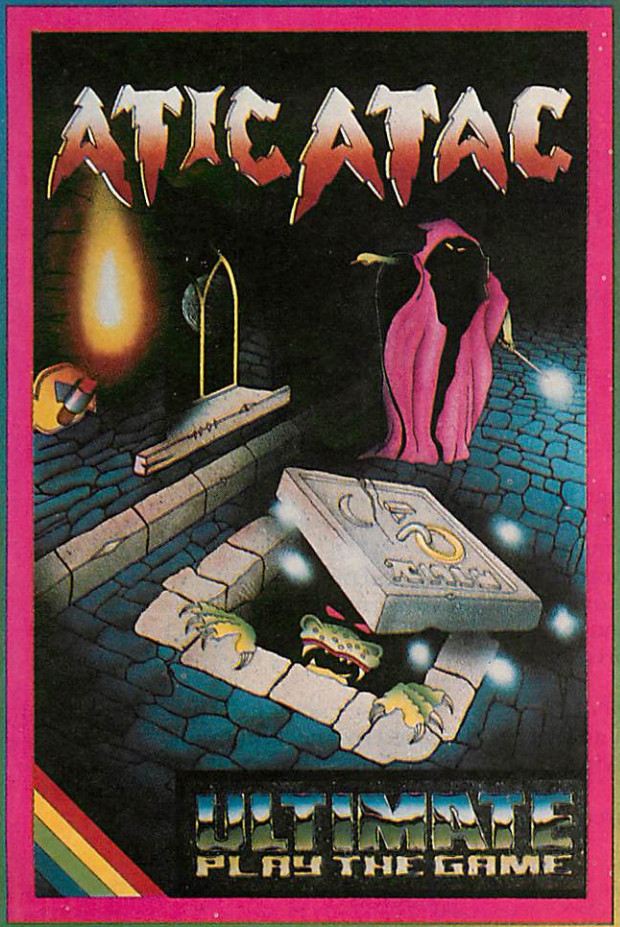
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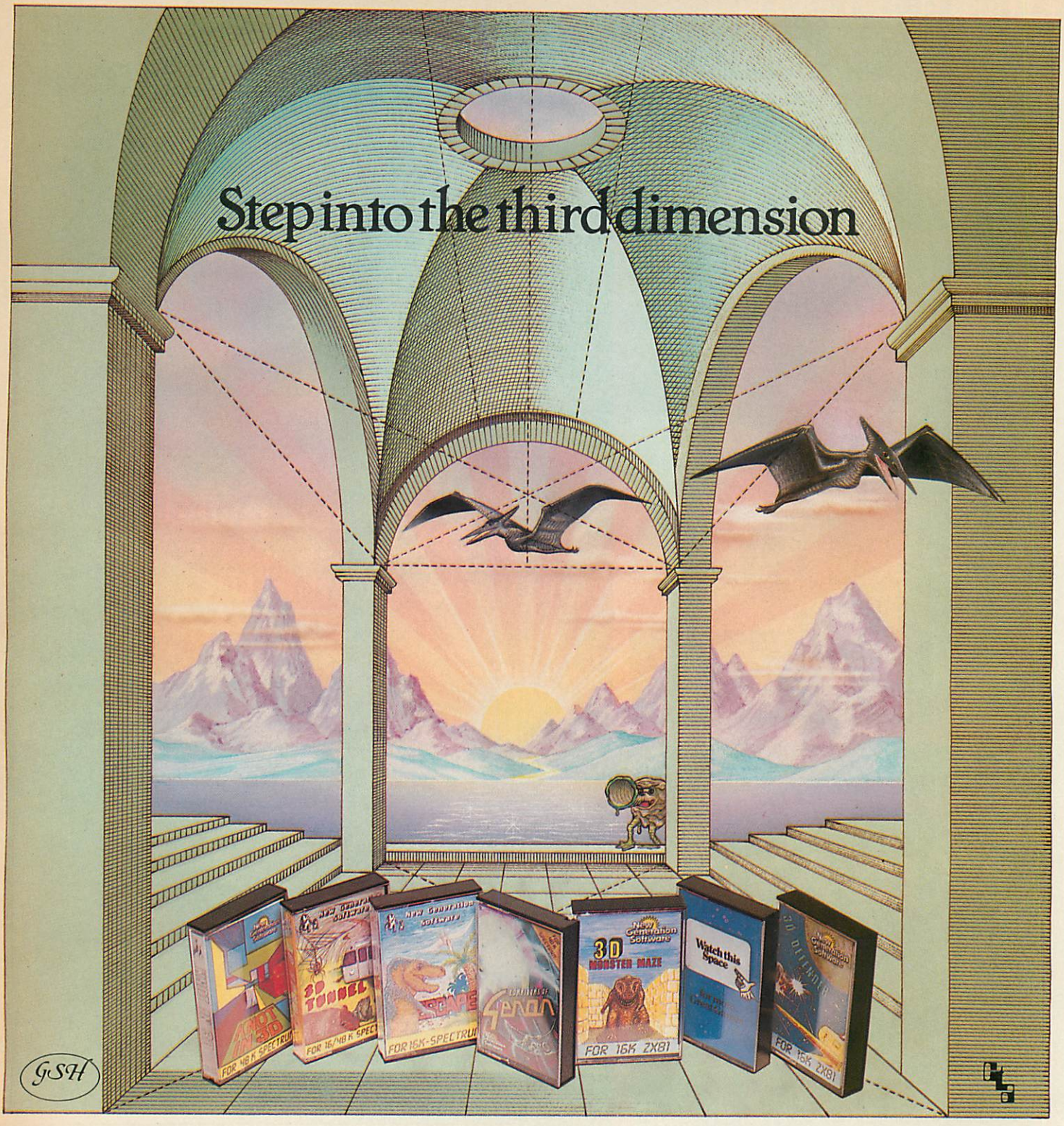
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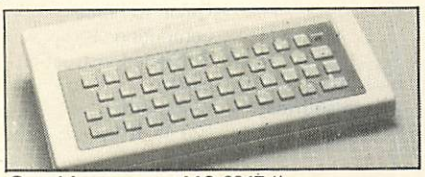
(continued from page 96)

Language	Basic
ROM	16K
Processor	6502
Graphics	6502
Sound	—
Pixel res	176 by 160
Colour res	—
Colours	16
Graphics	User-defined
UDG	
Sounds	Three music plus one noise
Manuals	—
Accessories:	£170 printer £45 cassette £20 3K RAM £40 16K RAM £7.50 joystick

CONCLUSIONS:

- **For:** Lots of very good cheap software and many add-on goodies readily available. Excellent magazine articles and programs.
- **Against:** Small memory. Needs the Commodore cassette unit, whereas other computers can use any recorder. The separate modulator can be a nuisance.
- Very good value for money.

LASER 200 — 4K

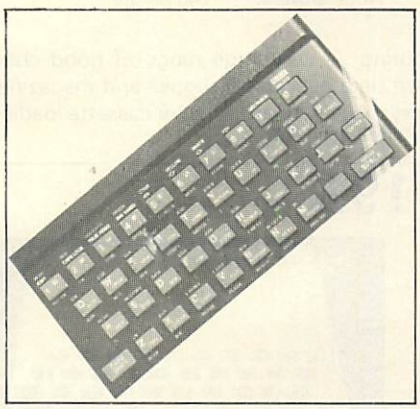


Cost	£70
Keyboard	Audible 45 moving keys Typed and keyword entry with auto repeat
Expansion	Edge connector Peripheral connector
Size	11½" × 6½" × 2"
Construction	Average
Editor	Screen
Line length	Two Multiple statements
Cassette I/F	600 baud
TV I/F	Domestic TV, monitor, video
M/C access	Peek, Poke, USR
Error messages	Full
Language	Basic
ROM	16K
Processor	Z-80A
Graphics	MC 6847 I'cs
Pixel res	128 by 64
Colour res	128 by 64
Colours	Nine
Sounds	Single channel
Manuals	Three: Basic manual Setting up manual Application manual
Accessories:	£20 Centronics I/F £20 joystick/pair £30 16K memory

CONCLUSIONS:

- **For:** A fast Basic with program entry either typed in full or keyword. Spacing of program is non-critical. Colour resolution good. Cheap software.
- **Against:** Poor high resolution, without mixed text. No user-defined graphics. Not much software available. Small memory available to user. PSU gets hot.
- Cheaper colour computer at present available.

ZX SPECTRUM 16K

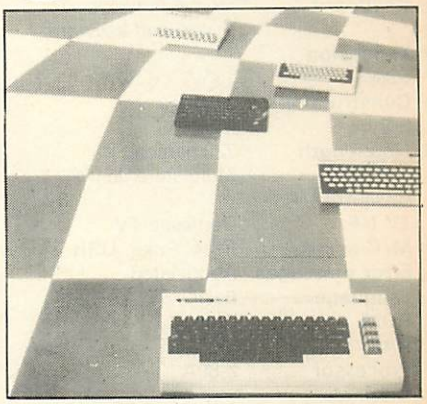


Cost	£100
Keyboard	Audible 40 moving keys Keyword — Auto-repeat
Expansion	42-way edge connector
Size	9" × 5½" × 1"
Construction	Good
Editor	Line editor (Excellent)
Line length	Unlimited Multiple statements
Cassette I/F	1500 baud (Good)
TV	Domestic TV, Video
M/C access	Peek, Poke, USR
Error messages	Numeric Codes
Language	Basic
ROM	16K
Processor	Z-80A
Graphics	ULA
Sound	ULA
Pixel res	256 by 192
Colour res	32 by 24
Colours	Eight
Sounds	Single channel
Manuals	Two: Introduction Basic programming (Excellent)
Accessories:	£40 printer £40 32K memory £30 Interface 1 £50 Microdrive £20 Interface 2

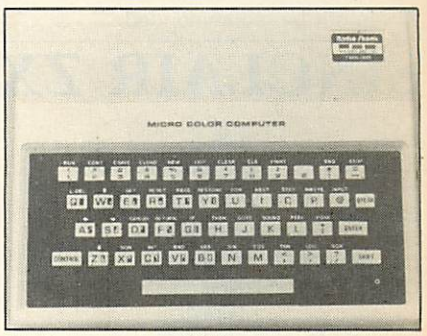
CONCLUSIONS:

- **For:** Largest selection of very good software. Very good technical back-up.
- **Against:** Sound is minimal. Keyboard could be better. Colour resolution is low.
- Best value for money, but only just.

ON THE GRID



TANDY MC10



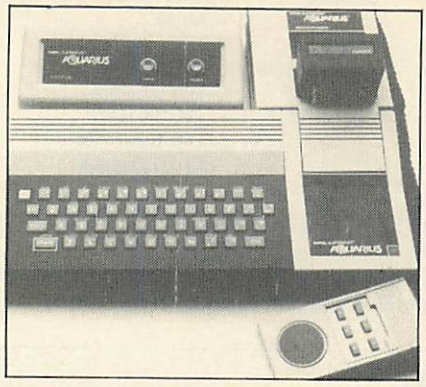
Cost	£100
Keyboard	48 moving keys Typed and keyword
Expansion	Edge connector RS-232 Interface
Size	8½" × 7" × 2"
Construction	Very good
Editor	N/A
Line length	Two lines Single statement
Cassette I/F	1500 baud (Very good)
TV I/F	Domestic TV
M/C access	Not available
Error messages	Abbr.
Language	Basic
ROM	—
RAM	4K
Processor	6803
Graphics	MC-6847
Sound	—
Pixel res	64 by 32
Colour res	64 by 32
Colours	Nine
Sounds	Single channel
Manuals	Installation (Poor) Basic programming (Good)
Accessories:	£80 printer £40 16K memory pack

CONCLUSIONS:

- **For:** Technical back-up from Tandy stores. Fast Basic.
- **Against:** Small keyboard, poor graphics, lacks an editor.
- Very basic colour computer.

AQUARIUS

Cost	£80
Keyboard	49 moving keys Typed and keyword
Expansion	—
Size	13½" × 6" × 2"
Construction	Average
Editor	N/A
Line length	72 characters Multi-statement
Cassette I/F	
TV I/F	Domestic TV
M/C access	Peek, Poke, USR
Error messages	Abbriviated
Language	Basic
ROM	—
RAM	4K
Processor	Z-80A
Graphics	—
Sound	—
Pixel res	80 by 72 (3 by 2 blocks)
Colour res	40 by 24
Colours	16
Sounds	Single channel



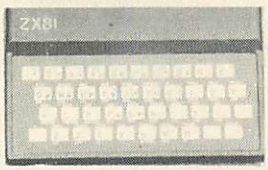
Manuals	Two: Guide to home computing Simplified instruction cards
Accessories:	£140 printer £20 4K RAM

CONCLUSIONS:

- **For:** Good set of graphics characters and symbols.
- **Against:** Has no editing facilities. Minimal sound. Keyboard is poor. Accessories are expensive. Not standard television lead.
- Can not be recommended.

SINCLAIR ZX-81 16K

Cost	£45
Keyboard	40 touch-sensitive membrane keys
Expansion	Edge connector
Size	7" × 7" × 1"
Construction	Average
Editor	Line (Good)
Line length	Unlimited Single statement
Cassette I/F	250 baud
TV I/F	Domestic TV
M/C access	Peek, Poke, USR
Error messages	Numeric codes



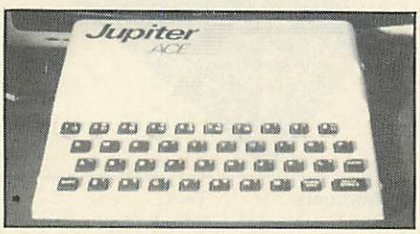
Language	Basic (slow)
ROM	8K
Processor	Z-80
Graphics	ULA
Sound	Not available
Pixel res	64 by 42
Manuals	ZX-81 Basic
Accessories:	£40 printer

CONCLUSIONS:

- **For:** The cheapest introduction to computing — very large range of good cheap software — very large amount of published data available in books and magazines.
- **Against:** No colour — no sound — not very nice keyboard — slow cassette loading.
- The cheapest way to start computing.

JUPITER ACE 19K

Cost	£90
Keyboard	40 moving keys
Expansion	Edge connector
Size	8½" × 7½" × 1"
Construction	Average
Editor	Line editor
Line length	Multiple statements
Cassette	—
TV	Domestic TV
M/C access	Yes
Error messages	Numeric codes
Language	Forth
ROM	8K
RAM	3K
Processor	Z-80A
Graphics	—
Sound	—

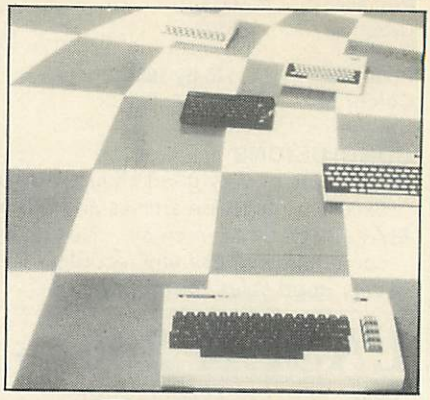


Pixel res	256 by 192
Colour res	Not available
Colours	Not available
Graphics	User-defined
Sounds	Single channel
Manuals	Forth programming
Accessories:	16K RAMpack

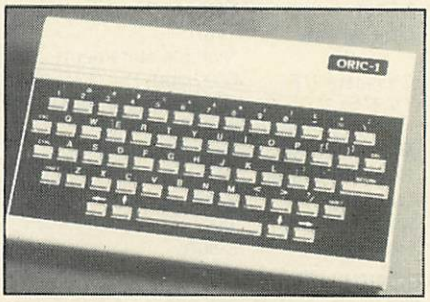
CONCLUSIONS:

- **For:** Very fast. A cheap way of learning an alternative computer language — Forth.
- **Against:** Not much software available. Keyboard could be better.
- At this price level, hard to justify.

ON THE GRID



ORIC 16K



Cost	£100
Keyboard	Audible 57 moving keys
Expansion	Edge connector Centronics port
Size	11" × 7" × 2"
Construction	Average
Editor	Line (Average)
Line length	78 characters Multiple statement lines
Cassette I/F	300-2400 baud (Average)
TV I/F	Domestic TV RGB O/P
M/C access	Peek, Poke, USR, Call
Error messages	Full
Language	Basic
ROM	16K
RAM	16K
Processor	6502-A
Graphics	—
Sound	GI 8912
Pixel res	240 by 200
Colour res	40 by 200
Colours	Eight
Sounds	Three music plus one noise
Manuals	Programming manual (Average)
Accessories:	£170 printer MCP

CONCLUSIONS:

- **For:** Has a high colour resolution capability and good sound facilities.
- **Against:** The ROM still contains errors. The documentation is not very good. Quality software is only just becoming available. Has a reputation for unreliability.
- Can do better.

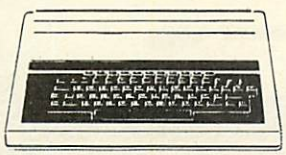
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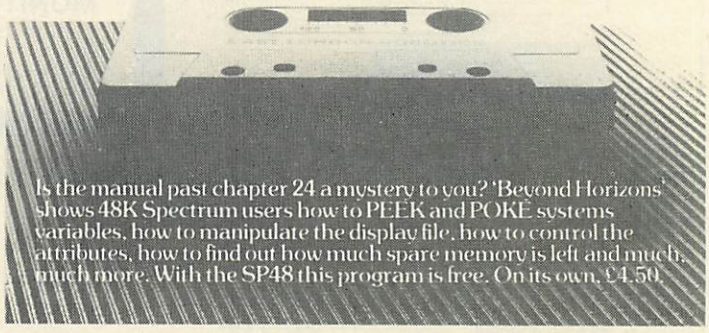
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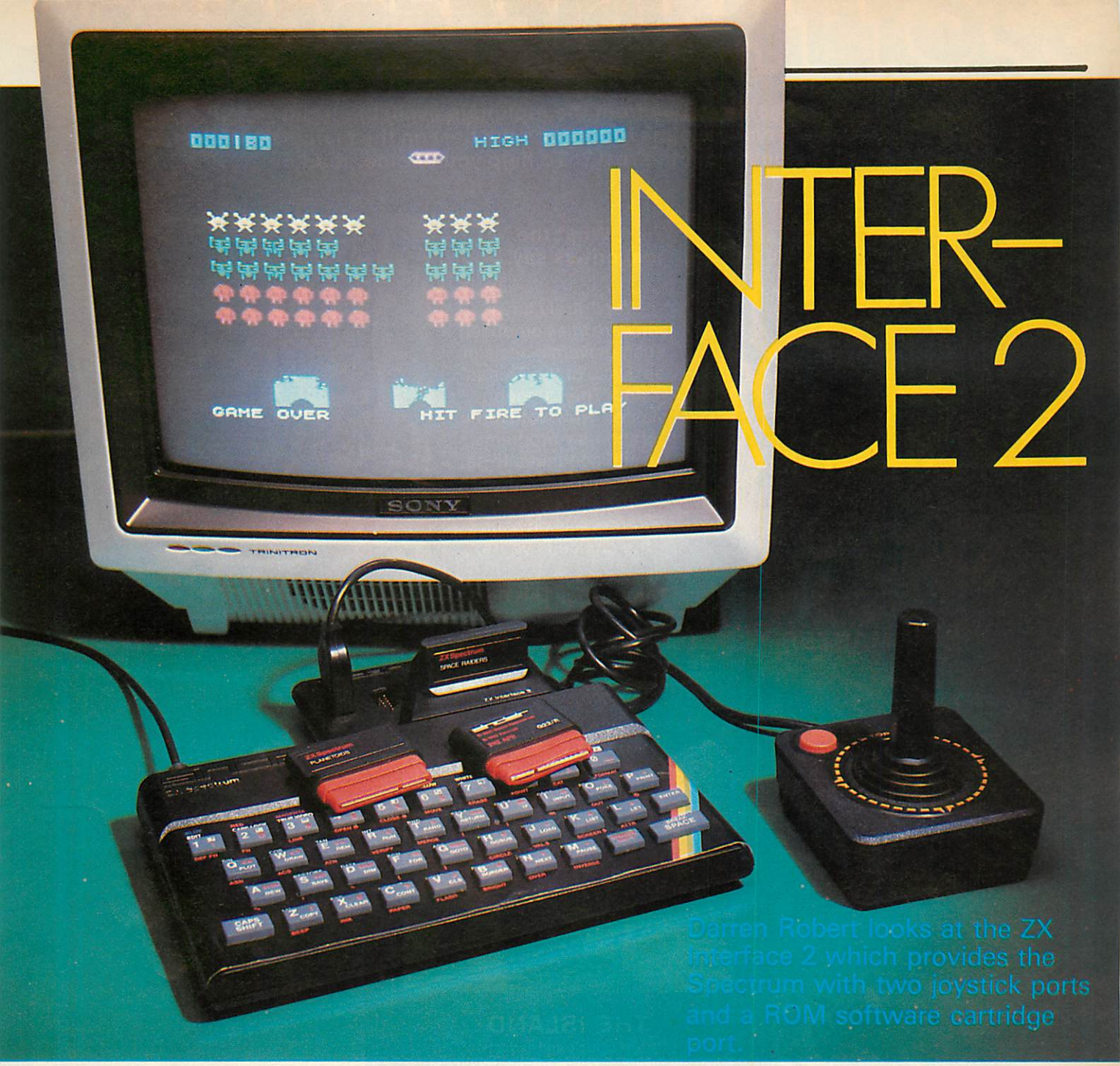
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INTER-FACE 2



Darren Robert looks at the ZX Interface 2 which provides the Spectrum with two joystick ports and a ROM software cartridge port.

SINCLAIR LAUNCHED THE ZX Interface 2 at the PCW show on September 28. At a cost of £19.95 plus £2.95 post and packing, it provides the Spectrum with ports for two standard joysticks and a ROM software cartridge port for which there are 10 programs available priced at £14.95 each.

The Interface plugs into the rear connector of the Spectrum or the Microdrive Interface 1, if attached. The only peripheral that can be plugged into the back of Interface 2 is the ZX printer as not all the normal connections are provided. Inside there is one printed circuit board, two joystick 9-pin D plus connectors, one ROM cartridge socket and just one integrated circuit chip.

The joysticks are operated as either keys 1 to 5, 6 to 0 or read using the IN command and bit testing — table 1. The ROM cartridge is a 2" by 1¾" by 3/8" black package with a recessed flat to indicate the front, and a flashy red rubber shroud to protect the goldplated contacts of the printed circuit board inside the casing. The shroud is simply pushed out of the way as the cartridge enters the interface socket. The cartridges will allow most 48K-based cassette software to run on a 16K machine when in cartridge format.

To use this extremely convenient method of program storage, switch off the Spectrum and simply plug Interface 2 into the back of the computer, insert the ROM cartridge after raising the protective cover, re-insert the power supply plug to switch on and the computer is ready to go.

Well, that is the theory, now what about the practice. The first problem is to raise the cartridge port cover, this clips into the interface casing which has a very small half-moon shaped cut-out providing access to the edge of the cover. Obviously the designer has long finger nails, because without them you will need a screwdriver or similar tool to prize open the cover.

There is no guide to position the polarised cartridge on initial entry into the port aperture. This means that if the cartridge enters at an angle or slightly to one side, it is not going to engage the socket. With interface in the hand, there is no real problem as you can see where everything fits. Piggy-back Interface 2 onto Interface 1 and assemble to the Spectrum on a desk and it is not so easy — the cartridge slot is now no longer in direct line of sight.

The user will get used to it, but initially everyone who have tried it had difficulties.

The rubber shroud over the connector — it feels like a silicone rubber — may start off tight but after use it soon becomes loose, leaving a nice space between the cover and the connectors which can now pick up dirt. Even more worrying is the design of the shroud; there is a lip at the top which, because of the mould tool design, leaves a slither of rubber just waiting to come adrift. When it finally does, and it already shows signs of doing so on two of three cartridges that I have, contact will not be made on all the connections in the socket.

A minor point: I would have liked the title

(continued on page 107)

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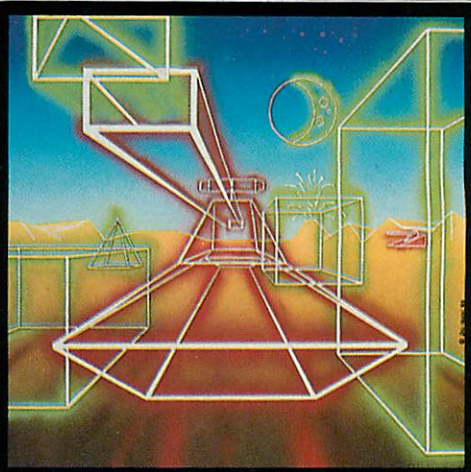


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CONCLUSIONS

- It is eight weeks since the launch of Interface 1 and this unit contains three connectors and one integrated circuit; the interfaces should have been combined.
- The ROM cartridge design implementation is poor and not what one normally hopes for from a Sinclair product.
- The joystick ports work well and I am sure the key choice is logical but I, and a lot of other users, will be less than pleased at having to change the interface to play some of the other independantly produced joystick games which do not use these keys.
- At £14.95 for cartridges, it is a very big increase in software price. Sinclair's advantage over the other machines in this price bracket is the range of software at very low cost. My view is that if the user intended to use mostly ROM-based software that the Vic-20 — £9.99 for cartridge — would be a better buy and a lot less trouble.

(continued from page 105)

on the top edge of the cartridge, the obvious way to store the cartridges is shroud pointing down, side by side.

The user has to switch off to load the ROM cartridge and to change from working with ROM software to Microdrive or cassette software. Why was not the opportunity taken to add the on/off switch that just about everybody would like, instead of leaving the continual plugging and unplugging of the power supply?

The joystick ports are fitted with a 9-pin D type plugs and use standard Atari/Commodore type joysticks. Two removable caps protect the plugs when the ports are not in use.

The ZX Interface 2 manual, a piece of card folded into three pages, is clear but has no diagrams. There is a simple program for drawing on the screen using a joystick and the information on how to read the joystick in a Basic program.

To err is human — to make the same mistake twice is daft. Interface 1 is fixed very firmly onto the Spectrum to alleviate the dreaded wobbles and we all applauded, Interface 2 just plugs in. Playing the cartridge games using the keyboard enthusiastically causes those unmistakable symptons, this sort of faulty design is unexcusable.

Table 1.

Key	Joy-stick 1	In 63486	Key	Joy stick 2	In 61438
1	Left	Bit 0	6	Left	Bit 4
2	Right	Bit 1	7	Right	Bit 3
3	Down	Bit 2	8	Down	Bit 2
4	Up	Bit 3	9	Up	Bit 1
5	Fire	Bit 4	0	Fire	Bit 0

Table 2.

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Table 3. Relative computer costs for running cartridge software.

	Spectrum	Vic-20	TI-99/4
Computer	£100	£100	£100
Cartridge I/F	£20	—	—
Invaders	£15	£10	£20
Chess	£15	£10	£35
TOTAL	£150	£120	£155

SKY HOP



Bounce the bug onto bags of baubles avoiding the buildings, bombs and boogies. Nicholas Sharp explains how using the Vic-20 with 3K expansion.

SKY HOP IS AN arcade-type program for the Vic-20 with 3K expansion. The game was originally inspired by the arcade version of Jump Bug and although the main body of the program is in Basic the game runs at a reasonable speed.

Because of the small amount of memory available to the user, even when a 3K expansion is in place, the game has had to be split into two programs. The first contains all the data for the 10 defined graphics and for the machine code routine which scrolls the screen right to left. This program also contains the instructions for the game and will automatically load the main program once the first program has been Run.

The second program is the main game. This uses all of the available memory left after the top of Basic has been lowered to protect the machine code and the defined graphics.

The aim of Sky Hop is for you, using the keys A-right, D-left, W-up and X-down, to bounce the bug on top of the various awards. These include money bags and diamonds. While doing this you must avoid the buildings, the bombs and the monsters. These are placed in different positions on each screen and if in your way they may be shot at using the key S-fire. Shooting monsters and bombs will also increase you score.

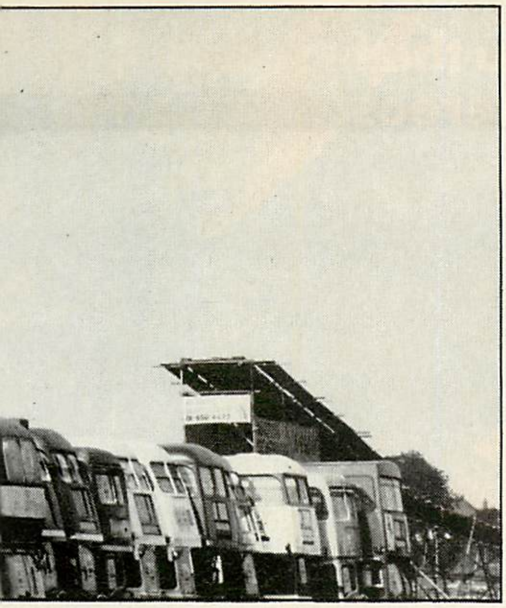
As previously mentioned the game has three levels. These are the city level, the ground level and the sky level. Once these have been completed and if you land on the home — which only passes below you once — you again move onto the city level. You may in all levels except the sky level bounce on the ground but as the ground is covered in bombs in the sky level doing so will end in destruction.

In all levels the bug is affected by gravity. In other words if no movement keys are pressed the bug automatically descends. The bug will also descend if its bounce runs out, so it is best to continually bounce on something.

During the game your score and the current

Program 1.

```
10 POKE52,26:POKE56,26:GOSUB650
20 REM-0.MONEY BAG
30 DATA60,24,102,239,199,239,195,126
40 REM-1.JUMP BUG
50 DATA48,120,164,166,255,255,255,102
60 REM-2.MONSTER
70 DATA66,36,60,90,126,102,60,102
80 REM-3&4.CLOUD
90 DATA47,125,249,253,253,103,3,0,248,28,95,95,30,244,224,0
100 REM-5.BUILDING
110 DATA255,153,153,153,255,153,153,153
120 REM-6.GROUND
130 DATA255,255,255,255,255,255,255,255
140 REM-7.BULLET
150 DATA0,0,0,6,31,63,31,6
160 REM-8.BOMB
170 DATA129,66,60,60,60,60,66,129
180 REM-9.DIAMOND
190 DATA66,153,44,94,255,126,60,24
200 REM-DATA FOR M/C
210 DATA169,19,32,210,255,169,29,32,210,255,169,13,32,210,255,169,0,141,60,3
220 DATA169,29,32,210,255,169,20,32,210,255,169,13,32,210,255,238,60,3,173,60,3
230 DATA201,21,208,231,96
240 REM-CHAR.DEFINE
250 FORX=7168TO7247:READY:POKEX,Y:NEXT
260 REM-REDEFINE SPACE
270 FORX=7424TO7431:POKEX,0:NEXT
280 REM-M/C FOR SCROLL
290 FORX=7248TO7293:READY:POKEX,Y:NEXT
300 REM-INSTRUCTIONS
310 PRINT"□□"
320 POKE36879,8:POKE36869,255
330 PRINT"□□□      INSTRUCTIONS"
340 PRINT"□       ____________"
350 PRINT"□□YOU CONTROL THE CAR(□A□)";
360 PRINT"□YOUR AIM IS TO LAND ONTHE MONEY BAGS(□□□)TO   GAIN POINTS.POINTS CAN
370 PRINT"□ALSO BE GAINED BY;     □1)JUMPING ON A CLOUD."
380 PRINT"□2)SHOOTING MONSTERS."
390 PRINT"□3)SHOOTING BOMBS."
400 PRINT"□4)JUMPING ON THE BONUS  DIAMONDS."
410 PRINT"□□□□PRESS ANY KEY TO CONT.":FORZ=1TO1000:NEXT
420 GETA$:IFA$=""THEN420
430 PRINT"□"
440 PRINT"□□□      SCORE CHART                        ____________"
450 PRINT"     □□□ □-50  POINTS"
460 PRINT"     □B □-100 POINTS"
470 PRINT"     □CD□-10  POINTS"
480 PRINT"     □H,□-50  POINTS"
490 PRINT"     □I'□-250 POINTS"
500 PRINT"□□□□PRESS ANY KEY TO CONT.":FORZ=1TO1000:NEXT
510 GETA$:IFA$=""THEN510
520 PRINT"□"
530 PRINT"□□□      USE THE KEYS                       ____________"
540 PRINT"□□      W□□□□□□A—+—D□□□□□□K"
550 PRINT"□□□□□□□□□□□□□□'S'-FIRE"
560 PRINT"□□□□□□  OR USE A JOYSTICK."
570 PRINT"□□□□□□PRESS ANY KEY TO CONT.":FORZ=1TO1000:NEXT
580 GETA$:IFA$=""THEN580
590 REM-LOAD MAIN PROG
595 PRINT"□□□□□□□□□□□□□□□□□PRESS PLAY ON TAPE NOW"
600 PRINT"□□□PLEASE WAIT WHILE MAIN    GAME IS LOADED"
610 PRINT"□□□";:POKE198,6:POKE631,76:POKE632,207
620 POKE633,13
630 POKE634,82:POKE635,213:POKE636,13
640 END
650 POKE36879,8
660 PRINT"□□□□□□       JUMP BUG                           ________"
670 PRINT"□□  FOR THE VIC 20 +3K"
680 PRINT"□□   (C) N.SHARP 1983"
690 FORX=1TO2500:NEXT:RETURN
```



high score are displayed at the top of the screen, and if your score is good enough your name can be entered into the score sheet. This score sheet contains the top three scores

Rather than using the keyboard for movement a joystick may be used. I find a joystick much easier to use, although this is probably due to lack of practice using the keyboard controls.

Finally, before Running either of the two programs they should both be Saved since an error in your typing may cause the machine to crash and for both the programs to be lost. If the games do crash the error is likely to be found in the data for the machine-code scroll in program 1.

Program 1. Running details.

10 — Lowers Ramtop to protect defined characters and machine code for scroll.
20 to 190 — Data for 10 defined characters.
200 to 230 — Data for machine code scroll.
250 — Pokes character data into locations 7168 to 7247.
270 — Redefines space-bar.
290 — Pokes machine code data into locations 7248 to 7293.
300 to 580 — Instructions.
590 to 640 — Loads main program.
650 to 690 — Title page routine.

Program 2. Running details.

10 — Defines function for random number.
20 to 170 — Initialises variables and sets up screen.
190 — Goto routine for city stage.
200 to 220 — Main loop for city stage.
240 — Goto routine for ground stage.
245 to 270 — Main loop for ground stage.
290 — Places bombs on the ground.
300 — Goto routine for sky stage.
305 to 330 — Main loop for sky stage.
350 to 370 — Loop for home stage.
380 to 400 — Place Home at locations 8158 to 8163.
420 — Goto cloud and diamond placing routines.
430 to 460 — Place a randomly sized building in the last column of the screen and place a money bag on top of it.
470 — Goto diamond placing routine.
490 to 520 — Randomly place a cloud in the last column of the screen and possibly place a monster on top of it.
540 to 550 — Place a diamond at ground level in last column of the screen.
570 to 580 — Places a monster at ground level in ground stage.
590 — Goto routine for placing clouds and diamonds.
610 — Place money bag at ground level.
630 to 680 — Place a low cloud randomly in last two columns of the screen and possibly place a monster on them.
690 to 730 — place a shelve randomly in last two columns of the screen and place a money bag on it.
750 to 850 — Title page routine and obtain the method of control.
870 to 900 — Display score sheet.
910 — Reset counter Q and return to title page.
920 to 950 — Give a value of 1 or 2 to JK depending on method of control.
970 to 1030 — Routine for reading the joystick.
1050 to 1100 — Routine for reading the keyboard.
1110 to 1175 — Check what occupies the bug's next square and act appropriately.
1176 to 1178 — Routine for restarting a game when home is reached.
1180 — Check for the bug hitting anything and act appropriately.
1190 to 1220 — Move the bug.
1240 to 1320 — Display the score if good enough and add name to high score list.
1340 — Reset bullet position to that of the bug.
1360 to 1410 — Routine for moving a bullet and check for a hit.
1430 to 1460 — Routine for dropping a bomb.

Program 2.

```
10 DEFFNR(X)=INT(RND(0)*X):DIMHI(4):DIMHI$(3),B(3)
20 POKE36869,255:POKE36879,8:PRINT"":POKE650,255:FORX=1TO3:HI(X)=0:HI$(X)="...
......":NEXT
30 U=0:CO=30720:SC=0:JB=7883:W=-1:GOSUB750:TI$="000000"
40 PRINT"HI"HI(1):FORX=7900TO7905:POKEX,6:POKEX+CO,1:NEXT
50 FORX=8164TO8185:POKEX,6:POKEX+CO,2:NEXT
60 FORX=7922TO8142STEP22:POKEX,5:POKEX+CO,3:NEXT
70 B(1)=8150:B(2)=8155:B(3)=8160
80 FORZ=1TO3
90 T=B(Z)-(22*FNR(14)):R=FNR(7)+1
100 FORX=B(Z)TOTSTEP-22:POKEX,5:POKEX+CO,R:NEXT
110 POKET-22,0:POKET-22+CO,1:NEXT
120 FORX=7878TO7883:POKEX,1:POKEX+CO,3:POKEX-1,32:FORT=1TO100:NEXT:NEXT
130 PRINT"READY"
140 FORT=1TO200:NEXT
150 PRINT"SET"
160 FORT=1TO200:NEXT
170 PRINT"GO!"
190 IFRND(0)<.6THENGOSUB420
200 SYS7248:ONJKGOSUB970,1060
210 IFTI$>"000030"THENGOTO240
220 GOTO190
240 IFRND(0)<.6THENGOSUB550
245 IFBO=0ANDRND(0)>.9THENBO=7713+FNR(11)
250 SYS7248:ONJKGOSUB970,1050:IFBO>0THENGOSUB1430
260 IFTI$>"000060"THENGOTO290
270 GOTO240
290 FORX=8164TO8185:POKEX,8:NEXT
300 IFRND(0)>.65THENGOSUB620
305 IFBO=0ANDRND(0)>.8THENBO=7713+FNR(11)
310 SYS7248:ONJKGOSUB970,1050:IFBO>0THENGOSUB1430
320 IFTI$>"000190"THENGOTO350
330 GOTO300
350 IFRND(0)>.3THEN380
360 SYS7248:ONJKGOSUB970,1050
370 GOTO350
380 FORT=8158TO8163:POKET,230:POKET+CO,1:NEXT
390 SYS7248:ONJKGOSUB970,1050
400 GOTO390
420 IFRND(0)<.2THENGOTO470
440 T=8163-(22*FNR(14)):R=FNR(7)+1
450 FORX=8163TOTSTEP-22:POKEX,5:POKEX+CO,R:NEXT
460 POKET-22,0:POKET-22+CO,1:Q=-1:RETURN
470 IFRND(0)<.3THENGOTO540
490 T=7833-(22*FNR(4))
500 POKET-1,3:POKET-1+CO,7:POKET,4:POKET+CO,7
510 IFRND(0)>.3THENPOKET-22,2:POKET-22+CO,3
520 RETURN
540 POKE8163,9:POKE8163+CO,7:RETURN
550 IFRND(0)<.5THENGOTO590
570 POKE8163,2:POKE8163+CO,1
580 RETURN
590 IFRND(0)<.7THENGOTO470
610 POKE8163,0:POKE8163+CO,3:RETURN
620 IFRND(0)<.5THEN690
640 T=8097-22*FNR(16):G=FNR(7)+1
650 POKET-1,3:POKET-1+CO,G:POKET,4:POKET+CO,G
660 IFRND(0)<.3THENRETURN
670 IFRND(0)>.5THENPOKET-22,2:POKET-22+CO,2:RETURN
680 POKET-23,2:POKET-23+CO,2:RETURN
690 T=8097-22*FNR(16)
710 FORX=0TO1:POKET-X,6:POKET-X+CO,1:NEXT
720 POKET-22-FNR(2),0
730 RETURN
750 PRINT"            JUMP BUG                 "
760 PRINT"    (C) N.SHARP 1983"
770 PRINT" JOYSTICK OR KEYBOARD"
780 PRINT"        (J OR K)"
790 GETA$:IFA$<>"K"ANDA$<>"J"THENQ=Q+1
800 IFQ>600THEN870
810 IFA$<>"K"ANDA$<>"J"THENGOTO790
820 POKE36878,15:POKE36876,220:POKE36876,0
830 GOTO870
840 PRINT""
850 RETURN
870 PRINT"SCORE  SHEET                 "
880 FORX=1TO3
890 PRINT""X""HI(X),HI$(X)
900 NEXT
910 IFQ>600THENQ=0:FORX=1TO2500:NEXT:GOTO750
920 FORX=1TO3500:NEXT
930 IFA$="J"THENJK=1
940 IFA$="K"THENJK=2
950 GOTO840
970 J1=PEEK(37151):POKE37154,127:J2=PEEK(37152):POKE37154,255
980 DY=((J1AND4)=0)-(J1=62ORJ1=126)-((J1AND8)=0)
985 IFDY=-1THENU=U+1
990 DX=((J1AND16)=0)-((J2AND128)=0)
1020 IF(J1AND32)=0THENGOSUB1340
1030 GOTO1100
1060 GETA$:DY=(A$="W")-(A$="")-(A$="X")
1065 IFDY=-1THENU=U+1
1070 DX=(A$="A")-(A$="D")
1090 IFA$="S"THENGOSUB1340
1100 IFW>=0THENGOSUB1360
1110 IFU>10THENDY=1
1120 IFDY<>0ORDX<>0THENMO=DX+(22*DY)
1130 P=PEEK(MO+JB):IFP=32THEN1190
1135 IF(JB-7680)/22=INT((JB-7680)/22)THENJB=JB+1
1140 IFP=0THENPOKEMO+JB,32:MO=-MO:POKE36877,220:POKE36877,0:SC=SC+50:U=0:GOTO11
90
1150 IFP=9THENPOKEMO+JB,32:MO=-MO:POKE36876,220:POKE36876,0:SC=SC+250:U=0:GOTO1
190
1160 IFP=3ORP=4THENMO=-MO:POKE36877,130:POKE36877,0:SC=SC+10:U=0:GOTO1190
1170 IFP=6THENMO=-MO:U=0:GOTO1190
1175 IFP<>230THEN1180
1176 FORX=128TO255STEP.3:POKE36876,X:POKE36875,X:NEXT:SC=SC+1000:TI$="000000":J
B=7883
1177 PRINT"  WELL DONE GO ON TO  NEXT ROUND,AND GAIN A      BONUS OF 1000
"
1178 FORX=1TO3500:NEXT:PRINT"":POKE36876,0:POKE36875,0:U=0:GOTO40
1180 IFP<>32ANDP<>1THENGOSUB1240
1190 POKEJB-1,32:JB=JB+MO
1195 IF(JB-7680)/22=INT((JB-7680)/22)THENJB=JB+1
1196 IFJB<7724THENJB=JB+22
1200 POKEJB,1:POKEJB+CO,2
1210 PRINT"SCORE";SC
1220 RETURN
1240 POKEJB-1,32:POKEJB+MO,56:FORX=15TO1STEP-.1:POKE36877,128:POKE36878,X:NEXT
1250 PRINT"":POKE36877,0
1255 PRINT"    YOU SCORED "SC
1260 FORX=1TO3:IFSC>HI(X)THENPRINT"WELL DONE YOUR RANKING          IS"X:GOTO
1280
1270 NEXT:GOTO30
1280 FORT=3TOXSTEP-1:HI(T)=HI(T-1):HI$(T)=HI$(T-1):NEXT
1295 FORT=1TO3500:NEXT:HI(X)=SC:PRINT"ENTER YOUR NAME PLEASE"
1297 PRINT"PRESS RETURN TO ENTER."
1300 PRINT""X""HI(X),".........."
1310 POKE198,0:INPUT"";HI$(X):IFLEN(HI$(X))>10THEN1295
1320 GOTO30
1340 W=0:F=JB:RETURN
1360 W=W+2
1370 POKEF-1,32:F=F+W:POKEF,7:POKEF+CO,1
1380 IFPEEK(F+1)=2THENSC=SC+50:W=11:POKEF+1,32:POKE36877,250
1385 IFPEEK(F+1)=8THENPOKE36877,220:SC=SC+50:W=11:POKEF+1,32
1390 IFPEEK(F+1)<>32THENW=11
1400 POKE36877,0:IFW<10THENRETURN
1410 POKEF,32:W=-1:RETURN
1430 POKEBO-1,32:BO=BO+21:POKEBO,8:POKEBO+CO,2
1450 IFPEEK(BO+22)<>32THENBO=0
1460 RETURN
```

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This game requires a colour television set and the special 3D glasses provided with each game.

CalcSheet, similar to the commerically available VisiCalc, is designed to provide a spreadsheet for the BBC Model B. Keith Miles explains.



BBC CALCSHEET

VISICALC has proved to be one of the most successful programs ever written. It is also one of the most expensive and its competitors are little cheaper. CalcSheet was written as an exercise in commercial programming and to provide a workable spreadsheet for the BBC Model B Micro. It will run on a Model A but, owing to the BBC's inefficient use of memory in dimensioning arrays, the size of the spreadsheet is severely limited.

CalcSheet is a very useful program and you may find that you no longer need to write or buy software for many applications.

For those that do not know what a spreadsheet is or does, the VDU screen is a window onto a large grid — configured like a piece of graph paper — each element of which can contain text or numerical data, and which permits cells to be related to each other. These relationships will be in the form of calculations which are entered in algebraic form referencing each cell that forms a part of the calculation by its horizontal and vertical co-ordinates. Calculations can include elements which are the results of other calculations — these need to be prefixed. The program is extremely powerful as all the BBC functions are supported plus the facility to sum rows or columns.

Owing to the limitations of memory on the BBC Micro certain features of the better spreadsheet programs have not been included, for example, variable column width and the creation of "windows". However, the dimensions of the spreadsheet are not fixed and the user may configure the spreadsheet to suit the purpose of any particular application. The facility also exists to quickly page through the spreadsheet.

The program basically consists of a two-dimensional string array, each cell of which is referenced by up to 52 horizontal elements from capital letter A to lower case z and as many vertical elements as memory will permit, referenced numerically. On a 40 by 40 spreadsheet the top row would be referenced A1, B1, C1 to z1 and the bottom row A40, B40, C40 to z40.

The user moves a cursor about the spreadsheet using the grey cursor keys. To make entries, move the cursor to the location required, press the Copy key and type the entry. On pressing Return it will be entered on to the spreadsheet. Owing to the possibility that each entry may alter the results of other entries — where they are calculations — the

(continued on page 113)

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(continued from page 111)

contents of the current page of the spreadsheet is re-calculated in full. It is for this reason that the screen is limited to four by 10 cells.

The program has options to Save and Load a spreadsheet to/from tape and to print either the spreadsheet variables or the results of the spreadsheet calculations. The program is configured for an Epson MX-80 series printer.

Most of the features are explained within the program and can be extracted from the instructions included in the listing. The program runs exclusively in Mode 7 and is configured for either Operating System. OS 1.2 permits colour codes to be embedded in the text and is therefore more memory-efficient. The variables used in the program are:

sheets$(row%,column%) – two dimensional string array;

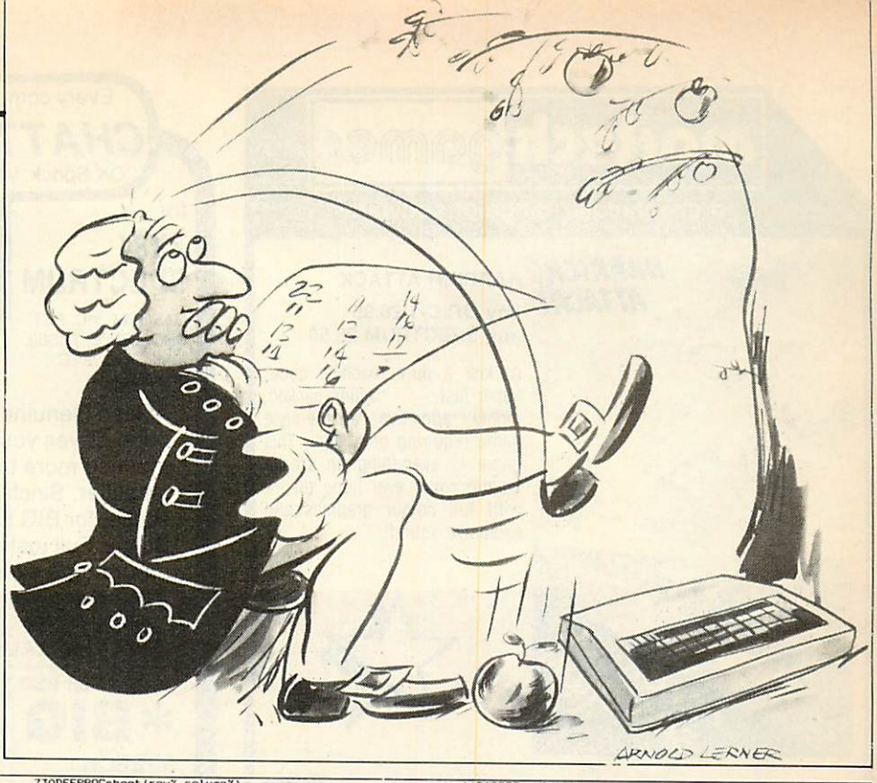
tab%(I%) – tab positions;

variables ending with % are integer variables (used to economise on memory).

The procedures used are:

Procinstruction – instruction procedure;

(continued on page 115)



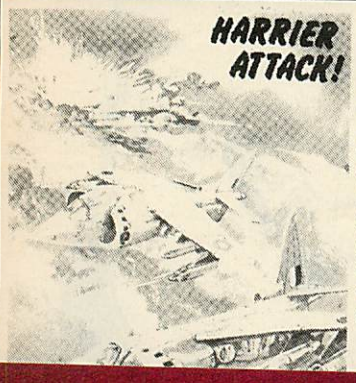

```
    1REM Copyright: K. D. MILES. 4,Willow Walk. ELY. C
ambs.
  10*KEY10OLD!M
  20ONERRORGOTO60
  30RD$=CHR$129:GN$=CHR$130:YW$=CHR$131:CY$=CHR$134:W
H$=CHR$135
  40UI$=CHR$132+CHR$157+CHR$134
  50I$=CHR$134+CHR$157+CHR$132
  60 VDU26,12:PRINTYW$"  SPREADSHEET DIMENSIONS"
  70PRINT'CY$"  The dimensions of the spreadsheet" CY
$"  are set by the user following these"'CY$"  simple
rules:"
  80PRINT'CY$"1.The spreadsheet must not exceed"'CY$"
1600 locations, typically a 40 by 40"'CY$"  grid."
  90PRINT'CY$"2.Length is set in multiples of 4"'CY$"
e.g. 4,8,12 etc., but may not"'CY$"  exceed 52."
 100PRINT'CY$"3.Height is set in multiples of 10"'CY$
"  and the limit is the restriction on"'CY$"  overall
spreadsheet size (see 1)."
 110VDU28,0,24,39,18
 120VDU12,7:PRINTYW$;:INPUT"  ENTER LENGTH (see 2)",h
%
 130IFh%>52THEN120
 140IFh%MOD4>0THEN120
 150VDU28,0,24,39,20
 160VDU12,7:PRINTYW$;:INPUT"  ENTER HEIGHT (3 and 1)"
,v%
 170IFh%*v%>1700THEN160
 180IFv%MOD10>0THEN160
 190VDU23,1,0;0;0;0;
 200DIMsheet$(v%,h%),tab%(8)
 210Fh%<26 FORI%=1TOh%:sheet$(0,I%)=CHR$(I%+64):NEXT
:GOTO240
 220FORI%=1TO26:sheet$(0,I%)=CHR$(I%+64):NEXT
 230FORI%=27TOh%:sheet$(0,I%)=CHR$(I%+70):NEXT
 240FORI%=1TO9:sheet$(I%,0)=" "+STR$(I%)+".":NEXT
 250FORI%=10TOv%:sheet$(I%,0)=STR$(I%)+".":NEXT
 260point%=0:carry%=0:length%=0:width%=0:print%=0:low
er%=0
 270FORI%=1TO8:tab%(I%)=I%*9:NEXT
 280ONERRORGOTO3720
 290VDU26,12:PRINTTAB(5,1)YW$"CALC-SHEET"
 300PRINT'CY$"  1. Spreadsheet instructions"
 310PRINT'CY$"  2. Load spreadsheet"
 320PRINT'CY$"  3. Layout and utilise spreadsheet"
 330PRINT'CY$"  4. Output to printer"
 340PRINT'CY$"  5. Save spreadsheet"
 350PRINT'CY$"  6. Exit spreadsheet"
 360VDU28,0,23,39,17
 370PRINTTAB(5)YW$;:INPUT"ENTER OPTION",E%
 380IFE%<1OR E%>6 CLS:GOTO370
 390VDU26,12:ON E%GOTO400,410,420,430,440,450
 400PROCinstruction:GOTO290
 410PROCload:GOTO290
 420PROCspreadsheet:GOTO290
 430PROCprint:GOTO290
 440PROCsave:GOTO290
 450PROCexit
 460DEFPROCinstruction
 470PRINTCY$"  SPREADSHEET INSTRUCTIONS"
 480PRINT'"1. Use"YW$"<GREY CURSOR KEYS>"WH$"to move
the"'"  cursor around the spreadsheet."
 490PRINT"2. To page quickly through spreadsheet"'"
press"YW$"<TAB>"WH$"and"YW$"<DELETE>"WH$"to cancel."
 500PRINT"3. Press"YW$"<COPY>"WH$"to enter or edit" "
 variables or text."
 510 PRINT"4. Precede text entries by a single"'"  h
ash"YW$"<£>"WH$"symbol e.g."YW$"£NAME."
 520PRINT"5. Column width is"YW$"9 CHARACTERS."
 530PRINT"6. Enter"YW$"EQUATIONS"WH$"in normal algebr
aic"'"  form, referencing elements by their"'"  hori
zontal and vertical co-ordinates"'"  and entering"YW$
"FUNCTIONS"WH$"in"YW$"BRACKETS"'"  e.g."YW$"A1+B9*SQR
(25)+ABS(Z39)."
 540PRINT"7. To"YW$"SUM"WH$"rows or columns you may e
nter"'"  equations in the form"YW$"@A1)A20."
 550PRINT"8. Precede equations that include the"'"  "
YW$"RESULTS"WH$"of other calculations with a"'"  "YW$"
(&)"WH$"symbol and"YW$"BRACKET"WH$"entries"'"  e.g."Y
W$"(&A1)+N10+b39."
 560PROCstart
 570CLS:PRINT"9. Press"GN$"<RETURN>"WH$"to return to
options."
 580PRINT"10.To abort at any time press"RD$"<ESCAPE>.
"
 590 PRINT'"  DO YOU WISH TO SET THE NUMBER OF"'"
DECIMAL PLACES"YW$"(YES/NO)";:INPUTA$
 600IFLEFT$(A$,1)<>"Y"THEN620
 610INPUT'"  NUMBER OF DECIMAL PLACES",point%
 620PROCstart
 630ENDPROC
 640DEFPROCspreadsheet
 650CLS
 660row%=1:column%=1:hor%=1:ver%=1:lgth%=9:wdth%=3:pa
ge%=0
 670PROCheading
 680PROCverlabel
 690PROChorlabel
 700PROCsheet(row%,column%)
 710PROCcursor(hor%,ver%)
 720ENDPROC
 730DEFPROCsheet(row%,column%)
 740IFprint%=1THEN750 ELSE VDU28,3,24,39,4:CLS
 750FORI%=column%TO column%+lgth%
 760temp%=1
 770FORJ%=row%TO row%+wdth%
 780IFprint%=1AND I%=0 PRINTTAB(tab%(temp%)-5);sheet$
(I%,J%);:GOTO880
 790A$=sheet$(I%,J%)
 800IFA$="" THEN880
 810IFLEFT$(A$,1)="£"THEN870
 820IFLEFT$(A$,1)="^" A$=RD$+"BRACKET"+WH$:GOTO870
 830IFLEFT$(A$,1)="\" A$=RD$+"ERROR"+WH$:GOTO870
 840IFLEFT$(A$,1)="(" A$=RD$+"RESULTS"+WH$:GOTO870
 850PROCcalculation
 860PROCdecimal
 870PROCformat
 880temp%=temp%+1
 890NEXT:PRINT
 900IFprint%=0 PRINT
 910NEXT
 920ENDPROC
 930DEFPROCcursor(hor%,ver%)
 940HOR%=hor%:VER%=ver%:HOR=hor%:VER=ver%:COL%=ver%:R
OW%=hor%
 950VDU26:IFROW%<27 asc%=64 ELSE asc%=70
 960PRINTTAB(10,2)CHR$(ROW%+asc%)STR$(COL%)"> "
 970PRINTTAB(12,0)STRING$(27," ")TAB(12,0)sheet$(COL%
,ROW%);":";
 980PRINTTAB(34,2);HIMEM-'2AND&FFFF
 990VDU28,3,24,39,3
1000*FX15,0
1010PRINTTAB(tab%(HOR)-9,VER*2);" ";TAB(tab%(HOR),VER
*2);" ";
1020PRINTTAB(tab%(hor%)-9,ver%*2);"^";TAB(tab%(hor%),
ver%*2);"^";
1030HOR=hor%:VER=ver%
1040*FX4,1
1050A=GET
1060IFA=136 hor%=hor%-1:ROW%=ROW%-1:IFROW%=0 ROW%=1:h
or%=1 ELSE IFROW%<HOR% PROCleft:GOTO950
1070IFA=137 hor%=hor%+1:ROW%=ROW%+1:IFROW%>h% ROW%=h%
:hor%=hor%-1 ELSE IFROW%>HOR%+3 PROCright:GOTO950
1080IFA=139 ver%=ver%-1:COL%=COL%-1:IFCOL%=0 COL%=1:v
er%=1 ELSE IFCOL%<VER% PROCup:GOTO950
1090IFA=138 ver%=ver%+1:COL%=COL%+1:IFCOL%>v% COL%=v%
:ver%=ver%-1 ELSE IFCOL%>VER%+9 PROCdown:GOTO950
1100IFA=135 PROCedit
1110IFA=9 page%=1:VDU26:PRINTTAB(35,1)"ON ":VDU28,3,2
4,39,4
1120IFA=127 page%=0:VDU26:PRINTTAB(35,1)"OFF":PROCshe
et(row%,column%)
1130IFA=13THEN1150
1140GOTO950
1150*FX4,0
1160ENDPROC
1170DEFPROCheading
1180PRINTTAB(0,0)U$"Contents<"TAB(0,1)U$"Edit-"TAB(30
,1)"Page-OFF"TAB(0,2)I$"Cursor<"TAB(30,2)"Mem-"
1190ENDPROC
1200DEFPROCverlabel
1210VDU28,0,24,39,4:CLS
1220FORC%=column%TO column%+lgth%
1230PRINTsheet$(C%,0)'
1240NEXT
1250ENDPROC
1260DEFPROChorlabel
1270VDU28,3,24,39,3:CLS
1280temp%=1
1290FORR%=row% TO row%+wdth%
1300PRINTTAB(tab%(temp%)-4);sheet$(0,R%);
1310temp%=temp%+1
1320NEXT
1330PRINT
1340ENDPROC
1350DEFPROCleft
1360row%=row%-4
1370HOR%=row%
1380PROChorlabel
1390IFpage%=1THEN1410
1400PROCsheet(row%,column%)
1410hor%=4
1420ENDPROC
1430DEFPROCright
1440row%=row%+4
1450HOR%=row%
1460PROChorlabel
1470IFpage%=1THEN1490
1480PROCsheet(row%,column%)
1490hor%=1
1500ENDPROC
1510DEFPROCup
1520column%=column%-10
1530VER%=column%
1540PROCverlabel
1550IFpage%=1THEN1570
1560PROCsheet(row%,column%)
1570ver%=10
1580ENDPROC
1590DEFPROCdown
1600column%=column%+10
1610VER%=column%
1620PROCverlabel
1630IFpage%=1THEN1650
1640PROCsheet(row%,column%)
1650ver%=1
1660ENDPROC
1670DEFPROCedit
1680VDU26
1690PRINTTAB(8,1)STRING$(22," ")
1700INPUTTAB(8,1),sheet$(COL%,ROW%)
1710A$=sheet$(COL%,ROW%)
1720IFLEFT$(A$,1)="£"AND LEN(A$)>10 VDU7:GOTO1690
1730IFROW%>width% width%=ROW%
1740IFCOL%>length% length%=COL%
1750PROCsheet(row%,column%)
1760ENDPROC
1770DEFPROCdecimal
1780C$="":K$=""
1790IFpoint%=0 A$=STR$(INT(VAL(A$))):GOTO1850
1800L%=INSTR(A$,"."):IFL%=0 A$=A$+LEFT$(".0000000",po
int%+1):GOTO1850
1810C$=LEFT$(A$,L%)
1820PROCpoint
1830IFcarry%=1 A$=STR$(VAL(C$)+1)+LEFT$(".0000000",po
int%+1):carry%=0:GOTO1850
1840A$=C$+K$
1850ENDPROC
1860DEFPROCpoint
1870K$=RIGHT$(A$,LEN(A$)-L%)
1880IFLEN(K$)=point% THEN1960
1890IFLEN(K$)<point% K$=point%-LEN(K$):K$=K$+LEFT$("0
000000",K$):GOTO1960
1900K$=LEFT$(K$,point%+1)
1910K1=VAL(LEFT$(K$,point%))
1920K2=VAL(RIGHT$(K$,1))
1930IFK2>5 K1=K1+1
1940K$=STR$(K1)
1950IFLEN(K$)>point% carry%=1
1960ENDPROC
1970DEFPROCformat
1980X%=LEN(A$)
1990IFLEFT$(A$,1)="£" PRINTTAB(tab%(temp%)-9)RIGHT$(A
$,LEN(A$)-1);:GOTO2010
2000PRINTTAB(tab%(temp%)-X%)A$;
2010ENDPROC
2020DEFPROCcalculation
2030IFINSTR(A$,"@") PROCresultsum("@"):GOTO2030
2040IFINSTR(A$,"%") PROCresultsum("%"):GOTO2030
2050PROCarray
2060A$=STR$(EVAL(C$))
2070ENDPROC
2080DEFPROCarray
2090C$=""
2100FORB%=1TO LEN(A$)
2110B$=MID$(A$,B%,1)
2120B=ASC(B$)
2130IF(B<65OR B>90)AND(B<97OR B>122)THEN2170
2140BB=ASC(MID$(A$,B%+1,1))
2150IF(B>96AND B<123)AND(BB>47AND BB<58) lower%=1:PRO
Cnumber:lower%=0:GOTO2170
2160IFBB>47AND BB<58 PROCnumber
2170C$=C$+B$
2180NEXT
2190ENDPROC
2200DEFPROCnumber
2210E$=B$:B$="":Y$=""
2220REPEAT
2230B%=B%+1
2240B$=MID$(A$,B%,1)
2250B=ASC(B$)
2260IFD>47OR D<58 E$=E$+D$
2270UNTIL D<48OR D>58
2280B%=B%-1
2290IFlower%=1 X%=ASC(LEFT$(E$,1))-70:GOTO2310
2300X%=ASC(LEFT$(E$,1))-64
2310Z%=VAL(RIGHT$(E$,LEN(E$)-1))
2320Y$=sheet$(Z%,X%):IFY$="" Y$="0"
2330B$=B$+Y$
2340ENDPROC
2350DEFPROCsum
2360F%=INSTR(A$,"]")
2370F1$=LEFT$(A$,F%-1)
2380F2$=RIGHT$(A$,LEN(A$)-F%)
2390A$=F1$:PROCarray:X%=X%:Z%=Z%
2400A$=F2$:PROCarray
2410G$=""
2420IFX%=x% PROCDown
2430IFZ%=z% PROCAcross
2440ENDPROC
2450DEFPROCDown
2460FORM%=z%TO Z%
2470A$=sheet$(M%,X%)
2480IFLEFT$(A$,1)="£"THEN2500
2490G$=G$+"+"+A$
2500NEXT
2510A$=G$
2520ENDPROC
2530DEFPROCAcross
2540FORM%=x%TO X%
2550A$=sheet$(Z%,M%)
2560IFLEFT$(A$,1)="£"THEN2580
2570G$=G$+"+"+A$
2580NEXT
2590A$=G$
```

(listing continued on page 115)


```
2640ENDPROC
2650DEFPROCresultsum(J$)
2660N%=INSTR(A$,J$)
2670A$=LEFT$(A$,N%-1)+RIGHT$(A$,LEN(A$)-N%)
2680W$="":REPEAT
2690W=ASC(MID$(A$,N%,1))
2700W$=W$+CHR$(W)
2710N%=N%+1:UNTIL (W<47OR W>58)AND(W<65OR W>93)AND(W<
97OR W>122)
2720W$=LEFT$(W$,LEN(W$)-1)
2730N%=INSTR(A$,W$)-1
2740W%=LEN(W$)
2750A1$=LEFT$(A$,N%):A2$=RIGHT$(A$,LEN(A$)-(N%+W%))
2760A$=W$
2770IFJ$="@" PROCsum ELSE PROCarray:A$=C$
2780A$=A1$+A$+A2$
2790ENDPROC
2800DEFPROCprint
2810PRINTCY$"  OUTPUT TO PRINTER"
2820VDU28,0,24,39,1
2830PRINT'"  Print A) Spreadsheet or"'TAB(9)"B) Vari
ables"YW$"(A/B)";:INPUTa$
2840IFa$<>"A"AND a$<>"B" CLS:GOTO2830
2850CLS:PRINT'"1. Check paper."
2860PRINT"2. Switch on the printer."
2870PRINT"3. To abort at any time press"RD$"<ESCAPE>.
"
2880PROCstart
2890IFa$="B" PROCprintV ELSE PROCprintS
2900ENDPROC
2910DEFPROCprintS
2920row%=1:column%=0:lgth%=length%:wdth%=7:print%=1
2930VDU2
2940REPEAT
2950FORDsheet(row%,column%)
2960row%=row%+8
2970UNTILrow%>=width%
2980VDU3
2990print%=0
3060temp%=0
3070FORJ%=row%TO row%+wdth%:IFJ%>26 asc%=70 ELSE asc%
=64
3080PRINTTAB(20*temp%)CHR$(J%+asc%)+STR$(I%)":";sheet
$(I%,J%);
3090temp%=temp%+1
3100NEXT:PRINT
3110NEXT:PRINT
3120row%=row%+wdth%
3130UNTILrow%>=width%
3140VDU3
3150ENDPROC
3160DEFFROCload
3170PRINTCY$"  LOAD SPREADSHEET"
3180PRINT"1. Place correct cassette in the tape"'"
recorder."
3190PRINT"2. Ensure that it is rewound."
3200PRINT"3. Enter the name of the spreadsheet to:IN
PUT"  be loaded",name$
3210IFLEN(name$)>10 VDU7,28,0,24,39,5,12:GOTO3200
3220PRINT"4. To abort at any time press"RD$"<ESCAPE>.
"
3230VDU28,10,22,30,19
3240PRINT"PLAY"
3250FILE=OPENIN(name$)
3260INPUTFILE,name$,length%,width%,point%
3270PRINT"Loading "name$
3280FORI%=1TO length%
3290FORJ%=1TO width%
3300INPUTFILE,sheet$(I%,J%)
3310NEXT
3320NEXT
3330CLOSEFILE
3340PROCoff
3350ENDPROC
3360DEFFROCsave
3370PRINTCY$"  SAVE SPREADSHEET"
3380PRINT"1. Place a blank cassette in the tape"'"
recorder."
3430VDU28,10,22,30,19
3440FILE=OPENOUT(name$)
3450PRINTFILE,name$,length%,width%,point%
3460PRINT"Writing "name$
3470FORI%=1TO length%
3480FORJ%=1TO width%
3490PRINTFILE,sheet$(I%,J%)
3500NEXT
3510NEXT
3520CLOSEFILE
3530PROCoff
3540ENDPROC
3550DEFPROCoff
3560PRINT"Finished"
3570VDU26
3580PRINTTAB(0,8)"5. Switch off tape recorder."
3590PROCstart
3600ENDPROC
3610DEFFROCexit
3620PRINTCY$"  EXIT SPREADSHEET"
3630PRINT'"1. Are you sure that you have finished?"
3640PRINT"2. Has the spreadsheet been saved on"'"  t
ape""
3650PRINT"3. Press"GN$"<ESCAPE>"WH$"to return to opti
ons."
3660PRINT"4. Press"RD$"<SPACE-BAR>"WH$"to exit CALC-S
HEET."
3670A$=GET$:IFA$<>" "THEN3670
3680PRINTCY$"  END"
3690VDU23,1,1;0;0;0;
3700END
3710ENDFROC
3720IFERR=17 VDU3:GOTO290
3730VDU26,12
3740IFERR=15ANDERL=2290 sheet$(I%,JX)=""+sheet$(I%,J
%):GOTO400
3750IFERR=19ANDERL=2750 sheet$(I%,JX)="("+sheet$(I%,J
%):GOTO400
3760sheet$(I%,J%)=")"+sheet$(I%,J%):GOTO400
```

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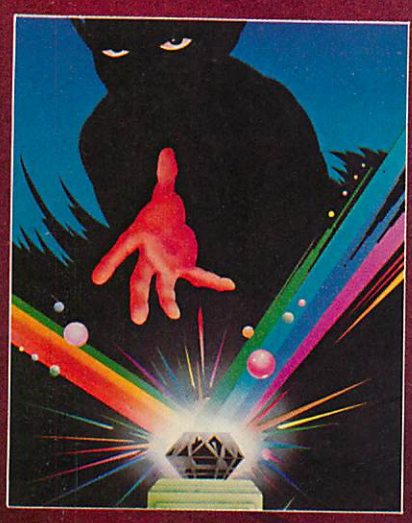
ZX81
SPECTRUM

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JUST AROUND THE CORNER, A NEW



BLACK CRYSTAL

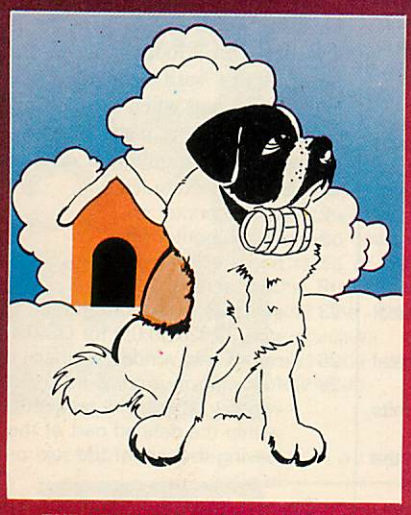
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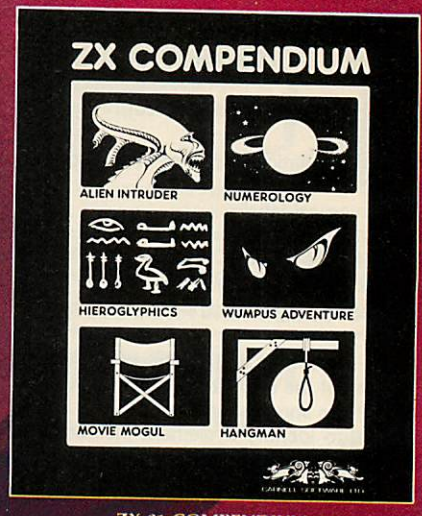


THE CRYPT
written by Stephen Renton

Prepare yourself for the many challenges that shall confront you when you dare to enter "THE CRYPT".

You will battle with giant scorpions, Hell spawn, Craners, Pos-Negs and if you are unlucky enough — the Dark Cyclops in this arcade style adventure.

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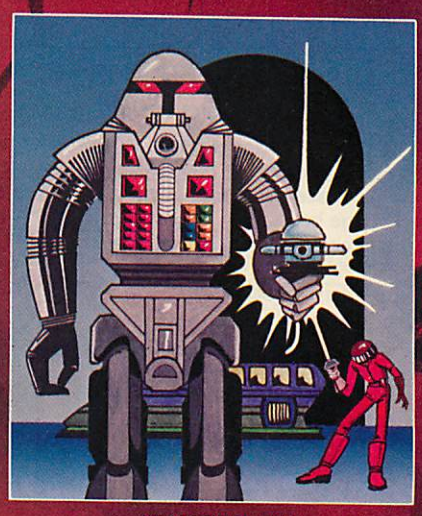
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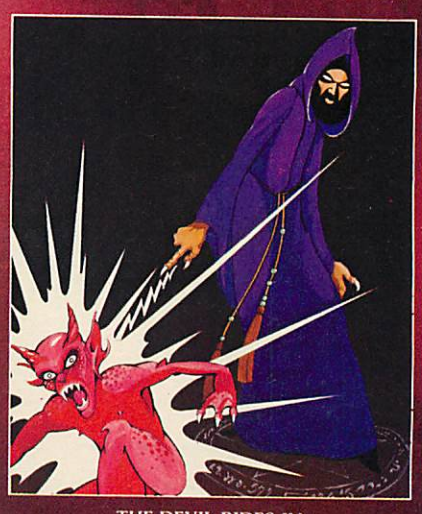
"Alien/Hieroglyphics/Wumpus/Movie — A varied mix from Carnell, all featuring imaginative responses and graphics and all of them good games for all ages (Hieroglyphics is particularly good for children)." (Popular Computing Weekly, Aug '82)



STARFORCE ONE

Take on the robot guardians of the central computer in a superbly stylised three dimensional battle game.

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THE DEVIL RIDES IN

I uttered the last incantations as the clock struck thirteen. All fell silent except for a faint rustling in the corner. From out of the shadows they came, all Hell's fury against me but I was not defenceless until the Angel Of Death, astride a winged horse, joined the battle. Avoiding his bolts of hell fire, I took careful aim. My chances were slim, but if my luck held . . .

(Fast moving, machine code, all action, Arcade game)

CalcSheet, similar to the commerically available VisiCalc, is designed to provide a spreadsheet for the BBC Model B. Keith Miles explains.



BBC CALCSHEET

VISICALC has proved to be one of the most successful programs ever written. It is also one of the most expensive and its competitors are little cheaper. CalcSheet was written as an exercise in commercial programming and to provide a workable spreadsheet for the BBC Model B Micro. It will run on a Model A but, owing to the BBC's inefficient use of memory in dimensioning arrays, the size of the spreadsheet is severely limited.

CalcSheet is a very useful program and you may find that you no longer need to write or buy software for many applications.

For those that do not know what a spreadsheet is or does, the VDU screen is a window onto a large grid — configured like a piece of graph paper — each element of which can contain text or numerical data, and which permits cells to be related to each other. These relationships will be in the form of calculations which are entered in algebraic form referencing each cell that forms a part of the calculation by its horizontal and vertical co-ordinates. Calculations can include elements which are the results of other calculations — these need to be prefixed. The program is extremely powerful as all the BBC functions are supported plus the facility to sum rows or columns.

Owing to the limitations of memory on the BBC Micro certain features of the better spreadsheet programs have not been included, for example, variable column width and the creation of "windows". However, the dimensions of the spreadsheet are not fixed and the user may configure the spreadsheet to suit the purpose of any particular application. The facility also exists to quickly page through the spreadsheet.

The program basically consists of a two-dimensional string array, each cell of which is referenced by up to 52 horizontal elements from capital letter A to lower case z and as many vertical elements as memory will permit, referenced numerically. On a 40 by 40 spreadsheet the top row would be referenced A1, B1, C1 to z1 and the bottom row A40, B40, C40 to z40.

The user moves a cursor about the spreadsheet using the grey cursor keys. To make entries, move the cursor to the location required, press the Copy key and type the entry. On pressing Return it will be entered on to the spreadsheet. Owing to the possibility that each entry may alter the results of other entries — where they are calculations — the

(continued on page 113)

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(continued from page 111)

contents of the current page of the spreadsheet is re-calculated in full. It is for this reason that the screen is limited to four by 10 cells.

The program has options to Save and Load a spreadsheet to/from tape and to print either the spreadsheet variables or the results of the spreadsheet calculations. The program is configured for an Epson MX-80 series printer.

Most of the features are explained within the program and can be extracted from the instructions included in the listing. The program runs exclusively in Mode 7 and is configured for either Operating System. OS 1.2 permits colour codes to be embedded in the text and is therefore more memory-efficient. The variables used in the program are:

sheets$(row%,column%) – two dimensional string array;

tab%(I%) – tab positions;

variables ending with % are integer variables (used to economise on memory).

The procedures used are:

Procinstruction – instruction procedure;

(continued on page 115)




```
    1REM Copyright: K. D. MILES. 4,Willow Walk. ELY. C
ambs.
   10*KEY10OLD:M
   20ONERRORGOTO60
   30RD$=CHR$129:GN$=CHR$130:YW$=CHR$131:CY$=CHR$134:W
H$=CHR$135
   40UI$=CHR$132+CHR$157+CHR$134
   50I$=CHR$134+CHR$157+CHR$132
   60 VDU26,12:PRINTYW$"  SPREADSHEET DIMENSIONS"
   70PRINT'CY$"  The dimensions of the spreadsheet" CY
$"  are set by the user following these"'CY$"  simple
rules:"
   80PRINT'CY$"1.The spreadsheet must not exceed"'CY$"
1600 locations, typically a 40 by 40"'CY$"  grid."
   90PRINT'CY$"2.Length is set in multiples of 4"'CY$"
e.g. 4,8,12 etc., but may not"'CY$"  exceed 52."
  100PRINT'CY$"3.Height is set in multiples of 10"'CY$
"  and the limit is the restriction on"'CY$"  overall
spreadsheet size (see 1)."
  110VDU28,0,24,39,18
  120VDU12,7:PRINTYW$;:INPUT"  ENTER LENGTH (see 2)",h
%
  130IFH%>52THEN120
  140IFH%MOD4>0THEN120
  150VDU28,0,24,39,20
  160VDU12,7:PRINTYW$;:INPUT"  ENTER HEIGHT (3 and 1)"
,v%
  170IFh%*v%>1700THEN160
  180IFv%MOD10>0THEN160
  190VDU23,1,0;0;0;0;
  200DIMsheet$(v%,h%),tab%(8)
  210IFh%<26 FORI%=1TOh%:sheet$(0,I%)=CHR$(I%+64):NEXT
:GOTO240
  220FORI%=1TO26:sheet$(0,I%)=CHR$(I%+64):NEXT
  230FORI%=27TOh%:sheet$(0,I%)=CHR$(I%+70):NEXT
  240FORI%=1TO9:sheet$(I%,0)=" "+STR$(I%)+".":NEXT
  250FORI%=10TOv%:sheet$(I%,0)=STR$(I%)+".":NEXT
  260point%=0:carry%=0:length%=0:width%=0:print%=0:low
er%=0
  270FORI%=1TO8:tab%(I%)=I%*9:NEXT
  280ONERRORGOTO3720
  290VDU26,12:PRINTTAB(5,1)YW$"CALC-SHEET"
  300PRINT'CY$"  1. Spreadsheet instructions"
  310PRINT'CY$"  2. Load spreadsheet"
  320PRINT'CY$"  3. Layout and utilise spreadsheet"
  330PRINT'CY$"  4. Output to printer"
  340PRINT'CY$"  5. Save spreadsheet"
  350PRINT'CY$"  6. Exit spreadsheet"
  360VDU28,0,23,39,17
  370PRINTTAB(5)YW$;:INPUT"ENTER OPTION",E%
  380IFE%<1OR E%>6 CLS:GOTO370
  390VDU26,12:ON E%GOTO400,410,420,430,440,450
  400PROCinstruction:GOTO290
  410PROCload:GOTO290
  420PROCspreadsheet:GOTO290
  430PROCprint:GOTO290
  440PROCsave:GOTO290
  450PROCexit
  460DEFPROCinstruction
  470PRINTCY$"  SPREADSHEET INSTRUCTIONS"
  480PRINT"1. Use"YW$"<GREY CURSOR KEYS>"WH$"to move
the""  cursor around the spreadsheet."
  490PRINT"2. To page quickly through spreadsheet""
press"YW$"<TAB>"WH$"and"YW$"<DELETE>"WH$"to cancel."
  500PRINT"3. Press"YW$"<COPY>"WH$"to enter or edit" "
 variables or text."
  510 PRINT"4. Precede text entries by a single""  h
ash"YW$"<£>"WH$"symbol e.g."YW$"£NAME."
  520PRINT"5. Column width is"YW$"9 CHARACTERS."
  530PRINT"6. Enter"YW$"EQUATIONS"WH$"in normal algebr
aic""  form, referencing elements by their""  hori
zontal and vertical co-ordinates""  and entering"YW$
"FUNCTIONS"WH$"in"YW$"BRACKETS""  e.g."YW$"A1+B9+SQR
(25)+ABS(Z39)."
  540PRINT"7. To"YW$"SUM"WH$"rows or columns you may e
nter""  equations in the form"YW$"@A3JA20."
  550PRINT"8. Precede equations that include the""  "
YW$"RESULTS"WH$"of other calculations with a""  "YW$"
<&>"WH$"symbol and"YW$"BRACKET"WH$"entries""  e.g."Y
W$"(&A1)+N10*b39."
  560PROCstart
  570CLS:PRINT"9. Press"GN$"<RETURN>"WH$"to return to
 options."
  580PRINT"10.To abort at any time press"RD$"<ESCAPE>.
"
  590 PRINT'"  DO YOU WISH TO SET THE NUMBER OF""
DECIMAL PLACES"YW$"(YES/NO)";:INPUTA$
  600IFLEFT$(A$,1)<>"Y"THEN620
  610INPUT'"  NUMBER OF DECIMAL PLACES",point%
  620PROCstart
  630ENDPROC
  640DEFPROCspreadsheet
  650CLS
  660row%=1:column%=1:hor%=1:ver%=1:lgth%=9:wdth%=3:pa
ge%=0
  670PROCheading
  680PROCverlabel
  690PROChorlabel
  700PROCsheet(row%,column%)
  710PROCcursor(hor%,ver%)
  720ENDPROC
  730DEFPROCsheet(row%,column%)
  740IFprint%=1THEN750 ELSE VDU28,3,24,39,4:CLS
  750FORI%=column%TO column%+lgth%
  760temp%=1
  770FORJ%=row%TO row%+wdth%
  780IFprint%=1AND I%=0 PRINTTAB(tab%(temp%)-5);sheet$
(I%,J%);:GOTO880
  790A$=sheet$(I%,J%)
  800IFA$=""THENBB0
  810IFLEFT$(A$,1)="£"THEN870
  820IFLEFT$(A$,1)="" A$=RD$+"BRACKET"+WH$:GOTO870
  830IFLEFT$(A$,1)="\" A$=RD$+"ERROR"+WH$:GOTO870
  840IFLEFT$(A$,1)="(" A$=RD$+"RESULTS"+WH$:GOTO870
  850PROCcalculation
  860PROCdecimal
  870PROCformat
  880temp%=temp%+1
  890NEXT:PRINT
  900IFprint%=0 PRINT
  910NEXT
  920ENDPROC
  930DEFPROCcursor(hor%,ver%)
  940HOR%=hor%:VER%=ver%:HOR=hor%:VER=ver%:COL%=ver%:R
OW%=hor%
  950VDU26:IFROW%<27 asc%=64 ELSE asc%=70
  960PRINTTAB(10,2)CHR$(ROW%+asc%)STR$(COL%)"> "
  970PRINTTAB(12,0)STRING$(27," ")TAB(12,0)sheet$(COL%
,ROW%);">";
  980PRINTTAB(34,2);HIMEM-!2AND&FFFF
  990VDU28,3,24,39,3
 1000*FX15,0
 1010PRINTTAB(tab%(HOR)-9,VER*2);" ";TAB(tab%(HOR),VER
*2);" ";
 1020PRINTTAB(tab%(hor%)-9,ver%*2);"";TAB(tab%(hor%),
ver%*2);"";
 1030HOR=hor%:VER=ver%
 1040*FX4,1
 1050A=GET
 1060IFA=136 hor%=hor%-1:ROW%=ROW%-1:IFROW%=0 ROW%=1:h
or%=1 ELSE IFROW%<HOR% PROCleft:GOTO950
 1070IFA=137 hor%=hor%+1:ROW%=ROW%+1:IFROW%>h% ROW%=h%
:hor%=hor%-1 ELSE IFROW%>HOR%+3 PROCright:GOTO950
 1080IFA=139 ver%=ver%-1:COL%=COL%-1:IFCOL%=0 COL%=1:v
er%=1 ELSE IFCOL%>VER% PROCup:GOTO950
 1090IFA=138 ver%=ver%+1:COL%=COL%+1:IFCOL%>v% COL%=v%
:ver%=ver%-1 ELSE IFCOL%>VER%+9 PROCdown:GOTO950
 1100IFA=135 PROCedit
 1110IFA=9 page%=1:VDU26:PRINTTAB(35,1)"ON ":VDU28,3,2
4,39,4
 1120IFA=127 page%=0:VDU26:PRINTTAB(35,1)"OFF":PROCshe
et(row%,column%)
 1130IFA=13THEN1150
 1140GOTO950
 1150*FX4,0
 1160ENDPROC
 1170DEFPROCheading
 1180PRINTTAB(0,0)UI$"Contents<"TAB(0,1)UI$"Edit-"TAB(30
,1)"Page-OFF"TAB(0,2)I$"Cursor<"TAB(30,2)"Mem-"
 1190ENDPROC
 1200DEFPROCverlabel
 1210VDU28,0,24,39,4:CLS
 1220FORC%=column%TO column%+lgth%
 1230PRINTsheet$(C%,0)'
 1240NEXT
 1250ENDPROC
 1260DEFPROChorlabel
 1270VDU28,3,24,39,3:CLS
 1280temp%=1
 1290FORR%=row% TO row%+wdth%
 1300PRINTTAB(tab%(temp%)-4);sheet$(0,R%);
 1310temp%=temp%+1
 1320NEXT
 1330PRINT
 1340ENDPROC
 1350DEFPROCleft
 1360row%=row%-4
 1370HOR%=row%
 1380PROChorlabel
 1390IFpage%=1THEN1410
 1400PROCsheet(row%,column%)
 1410hor%=4
 1420ENDPROC
 1430DEFPROCright
 1440row%=row%+4
 1450HOR%=row%
 1460PROChorlabel
 1470IFpage%=1THEN1490
 1480PROCsheet(row%,column%)
 1490hor%=1
 1500ENDPROC
 1510DEFPROCup
 1520column%=column%-10
 1530VER%=column%
 1540PROCverlabel
 1550IFpage%=1THEN1570
 1560PROCsheet(row%,column%)
 1570ver%=10
 1580ENDPROC
 1590DEFPROCdown
 1600column%=column%+10
 1610VER%=column%
 1620PROCverlabel
 1630IFpage%=1THEN1650
 1640PROCsheet(row%,column%)
 1650ver%=1
 1660ENDPROC
 1670DEFPROCedit
 1680VDU26
 1690PRINTTAB(B,1)STRING$(22," ")
 1700INPUTTAB(B,1),sheet$(COL%,ROW%)
 1710A$=sheet$(COL%,ROW%)
 1720IFLEFT$(A$,1)="£"AND LEN(A$)>10 VDU7:GOTO1690
 1730IFROW%>width% width%=ROW%
 1740IFCOL%>length% length%=COL%
 1750PROCsheet(row%,column%)
 1760ENDPROC
 1770DEFPROCdecimal
 1780C$="":K$=""
 1790IFpoint%=0 A$=STR$(INT(VAL(A$))):GOTO1850
 1800L%=INSTR(A$,"."):IFL%=0 A$=A$+LEFT$(".0000000",po
int%+1):GOTO1850
 1810C$=LEFT$(A$,L%)
 1820PROCpoint
 1830IFcarry%=1 A$=STR$(VAL(C$)+1)+LEFT$(".0000000",po
int%+1):carry%=0:GOTO1850
 1840A$=C$+K$
 1850ENDPROC
 1860DEFPROCpoint
 1870K$=RIGHT$(A$,LEN(A$)-L%)
 1880IFLEN(K$)=point% THEN1960
 1890IFLEN(K$)<point% K4=point%-LEN(K$):K$=K$+LEFT$("0
000000",K4):GOTO1960
 1900K$=LEFT$(K$,point%+1)
 1910K1=VAL(LEFT$(K$,point%))
 1920K2=VAL(RIGHT$(K$,1))
 1930IFK2>5 K1=K1+1
 1940K$=STR$(K1)
 1950IFLEN(K$)>point% carry%=1
 1960ENDPROC
 1970DEFPROCformat
 1980K%=LEN(A$)
 1990IFLEFT$(A$,1)="£" PRINTAB(tab%(temp%)-9)RIGHT$(A
$,LEN(A$)-1);:GOTO2010
 2000PRINTTAB(tab%(temp%)-K%)A$;
 2010ENDPROC
 2020DEFPROCcalculation
 2030IFINSTR(A$,"@") PROCresultsum("@"):GOTO2030
 2040IFINSTR(A$,"%") PROCresultsum("%"):GOTO2030
 2050PROCarray
 2060A$=STR$(EVAL(C$))
 2070ENDPROC
 2080DEFPROCarray
 2090C$=""
 2100FORB%=1TO LEN(A$)
 2110B$=MID$(A$,B%,1)
 2120B=ASC(B$)
 2130IF(B<65OR B>90)AND(B<97OR B>122)THEN2170
 2140BB=ASC(MID$(A$,B%+1,1))
 2150IF(B>96AND B<123)AND(BB>47AND BB<58) lower%=1:PRO
Cnumber:lower%=0:GOTO2170
 2160IFBB>47AND BB<58 PROCnumber
 2170C$=C$+B$
 2180NEXT
 2190ENDPROC
 2200DEFPROCnumber
 2210E$=B$:B$="":Y$=""
 2220REPEAT
 2230B%=B%+1
 2240D$=MID$(A$,B%,1)
 2250D=ASC(D$)
 2260IFD>47OR D<58 E$=E$+D$
 2270UNTIL D<48OR D>58
 2280B%=B%-1
 2290IFlower%=1 Y%=ASC(LEFT$(E$,1))-70:GOTO2310
 2300X%=ASC(LEFT$(E$,1))-64
 2310Z%=VAL(RIGHT$(E$,LEN(E$)-1))
 2320Y$=sheet$(Z%,Y%):IFY$="" Y$="0"
 2330B$=B$+Y$
 2340ENDPROC
 2350DEFPROCsum
 2360F%=INSTR(A$,"]")
 2370F1$=LEFT$(A$,F%-1)
 2380F2$=RIGHT$(A$,LEN(A$)-F%)
 2390A$=F1$:PROCarray:s%=X%:z%=Z%
 2400A$=F2$:PROCarray
 2410G$=""
 2420IFX%=s% PROCDown
 2430IFZ%=z% PROCAcross
 2440ENDPROC
 2450DEFPROCDown
 2460FORM%=z%TO Z%
 2470A$=sheet$(M%,X%)
 2480IFLEFT$(A$,1)="£"THEN2500
 2490G$=G$+"+"+A$
 2500NEXT
 2510A$=G$
 2520ENDPROC
 2530DEFPROCAcross
 2540FORM%=X%TO X%
 2550A$=sheet$(Z%,M%)
 2560IFLEFT$(A$,1)="£"THEN2580
 2570G$=G$+"+"+A$
 2580NEXT
 2590A$=G$
```

(listing continued on page 115)

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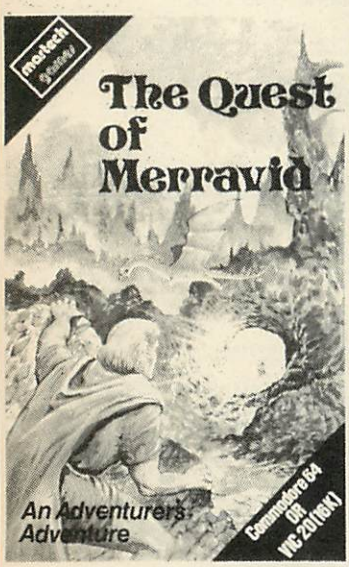
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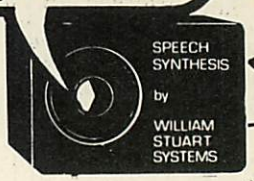
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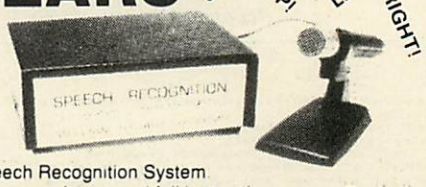
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BARCLAYCARD VISA

(continued from page 113)

Procload – load spreadsheet from tape;
Procspreadsheet – the main spreadsheet procedure.

Within the Procspreadsheet procedure are the following:
Procheading – information displayed at head of spreadsheet;
Procverlabel – vertical labels;
Prochorlabel – horizontal labels;
Procsheet(I,J) – the current "screen" of the spreadsheet to be displayed.

The Procsheet (I,J) procedure contains the following:
Procalculation – prints text or constructs and evaluates a string of the calculations which form each element of the spreadsheet by calling:
Proresultsum – to identify if element includes the results of another calculation or the sum of rows/columns. This procedure calls Procarray and Procsum. Procarray identifies horizontal – alphabetic – reference and contents. Procnumber identifies vertical – numeric – reference.
Prosum – calls Procarray to identify cells to be summed and calls: Procdown – to sum vertically; Procacross – to sum horizontally.

Other procedures are:
Procdecimal – rounds to specified number of demical places and calls:
Procpoint – to provide the fraction;
Procformat – formats the output: text left – justified and numeric data right – justified;
Proccursor – moves the cursor around the spreadsheet.

This last routine calls:
Procleft – to print preceding page;
Procright – to print following page;
Procup – page above the current one;
Procdown – page below;
Procedit – permits the input and alteration of entries;
Procprint – printer procedure.

This calls:
ProcprintV – to print variables;
ProcprintS – to print spreadsheet;
Procsave – save spreadsheet to tape;
Procexit – exit procedure, necessary as Escape key is used to return to options.

Multipurpose procedures are as follows:
Procstart – press space-bar to start;
Procoff – switch cassette off.

Various flags are used to permit procedures to be used by different procedures:
temp% – temporary variable used to set Tab positions;



point% – position of decimal point in number, held as a string;
carry% – position of decimal point in number, held as a.string;
carry% – rounding of decimal point .999 to give 1.00;
width% – far right entry in spreadsheet;
length% – lowest entry;
wdth% – number of columns, three for screen and seven for printer;
lgth% – length of columns, nine for screen, actual vertical dimension for printer;
print% – format for printer;
lower% – lower case array reference;
page% – page mode on/off;
hor% and ver% – horizontal and vertical position of cursor;
Hor and Ver – previous horizontal and vertical location of cursor;
Hor% and Ver% – horizontal and vertical limits of current page;
Row% and Col% – location of the cursor on the grid.

Line 980 returns the amount of free memory remaining.

The special feature of the program which makes it machine-dependent is the Eval function which can evaluate functions such as

2+3*SQR(81)+ABS(-9)

For other machines an alternative could be to carry forward a running total of the result so far using Val.

Repeat-Until loops can be substituted in other Basics with ordinary For-Next loops, exiting the loop when a condition is met.

Extensive use is made of VDU commands followed by a number of series of numbers which can be excluded:

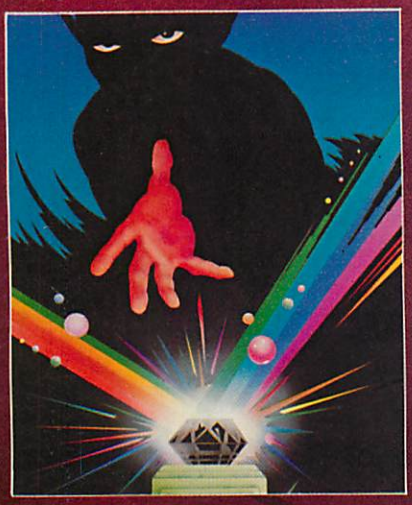
2 – switch printer on
3 – switch printer off
7 – ring a bell
12 – clear screen
23 – switches cursor off and on; use VDU23;8202;0;0;0 for OS 0.1
26 – return text window to initial value
28 – following four numbers create a text window, that is, all text is then printed within the defined part of the screen, leaving the rest of the text on the screen in place.

The error-handling facilities of the BBC are also used to avoid crashing the program as a result of not following the instructions, or if the string of the current calculation exceeds 255 characters. ■

(listing continued from page 113)

```
2600ENDPROC
2610DEFPROCstart
2620PRINT"CY$"  PRESS <SPACE-BAR>";
2630A$=GET$:IFA$<>" "THEN2630
2640ENDPROC
2650DEFPROCresultsum(J$)
2660N%=INSTR(A$,J$)
2670A$=LEFT$(A$,N%-1)+RIGHT$(A$,LEN(A$)-N%)
2680W$="":REPEAT
2690W=ASC(MID$(A$,N%,1))
2700W$=W$+CHR$(W)
2710N%=N%+1:UNTIL (W<47OR W>58)AND(W<65OR W>93)AND(W<
97OR W>122)
2720W$=LEFT$(W$,LEN(W$)-1)
2730N%=INSTR(A$,W$)-1
2740W%=LEN(W$)
2750A1$=LEFT$(A$,N%):A2$=RIGHT$(A$,LEN(A$)-(N%+W%))
2760A$=W$
2770IFJ$="@" PROCsum ELSE PROCarray:A$=C$
2780A$=A1$+A$+A2$
2790ENDPROC
2800DEFPROCprint
2810PRINTCY$"  OUTPUT TO PRINTER"
2820VDU28,0,24,39,1
2830PRINT'"  Print A) Spreadsheet or"'TAB(9)"B) Vari
ables"YW$"(A/B)";:INPUTa$
2840IFa$<>"A"AND a$<>"B" CLS:GOTO2830
2850CLS:PRINT'"1. Check paper."
2860PRINT"2. Switch on the printer."
2870PRINT"3. To abort at any time press"RD$"<ESCAPE>.
"
2880PROCstart
2890IFa$="B" PROCprintV ELSE PROCprintS
2900ENDPROC
2910DEFPROCprintS
2920row%=1:column%=0:lgth%=length%:wdth%=7:print%=1
2930VDU2
2940REPEAT
2950PROCsheet(row%,column%)
2960row%=row%+8
2970UNTILrow%>=width%
2980VDU3
2990print%=0
3000ENDPROC
3010DEFPROCprintV
3020row%=1:wdth%=3
3030VDU2
3040REPEAT
3050FORI%=1TO length%
3060temp%=0
3070FORJ%=row%TO row%+wdth%:IFJ%>26 asc%=70 ELSE asc%
=64
3080PRINTTAB(20*temp%)CHR$(J%+asc%)+STR$(I%)":"sheet
$(I%,J%)
3090temp%=temp%+1
3100NEXT:PRINT
3110NEXT:PRINT
3120row%=row%+wdth%
3130UNTILrow%>=width%
3140VDU3
3150ENDPROC
3160DEFPROCload
3170PRINTCY$"  LOAD SPREADSHEET"
3180PRINT"1. Place correct cassette in the tape"'"
recorder."
3190PRINT"2. Ensure that it is rewound."
3200PRINT"3. Enter the name of the spreadsheet to"'IN
PUT"  be loaded",name$
3210IFLEN(name$)>10 VDU7,28,0,24,39,5,12:GOTO3200
3220PRINT"4. To abort at any time press"RD$"<ESCAPE>.
"
3230VDU28,10,22,30,19
3240PRINT"PLAY"
3250FILE=OPENIN(name$)
3260INPUTEFILE,name$,length%,width%,point%
3270PRINT"Loading "name$
3280FORI%=1TO length%
3290FORJ%=1TO width%
3300INPUTEFILE,sheet$(I%,J%)
3310NEXT
3320NEXT
3330CLOSEEFILE
3340PROCoff
3350ENDPROC
3360DEFPROCsave
3370PRINTCY$"  SAVE SPREADSHEET"
3380PRINT"1. Place a blank cassette in the tape"'"
recorder."
3390PRINT"2. Ensure that it is rewound."
3400PRINT"3. Give the spreadsheet a name (less":INPUT
"  than 11 characters)",name$
3410IFLEN(name$)>10 VDU7,28,0,24,39,5,12:GOTO3400
3420PRINT"4. To abort at any time press"RD$"<ESCAPE>.
"
3430VDU28,10,22,30,19
3440FILE=OPENOUT(name$)
3450PRINTEFILE,name$,length%,width%,point%
3460PRINT"Writing "name$
3470FORI%=1TO length%
3480FORJ%=1TO width%
3490PRINTEFILE,sheet$(I%,J%)
3500NEXT
3510NEXT
3520CLOSEEFILE
3530PROCoff
3540ENDPROC
3550DEFPROCoff
3560PRINT"Finished"
3570VDU26
3580PRINTTAB(0,8)"5. Switch off tape recorder."
3590PROCstart
3600ENDPROC
3610DEFPROCexit
3620PRINTCY$"  EXIT SPREADSHEET"
3630PRINT'"1. Are you sure that you have finished?"
3640PRINT"2. Has the spreadsheet been saved on"'"  t
ape"?"
3650PRINT"3. Press"GN$"<ESCAPE>"WH$"to return to opti
ons."
3660PRINT"4. Press"RD$"<SPACE-BAR>"WH$"to exit CALC-S
HEET."
3670A$=GET$:IFA$<>" "THEN3670
3680PRINTCY$"  END"
3690VDU23,1,1;0;0;0;
3700END
3710ENDPROC
3720IFERR=17 VDU3:GOTO290
3730VDU26,12
3740IFERR=15ANDERL=2290 sheet$(I%,J%)=""+sheet$(I%,J
%):GOTO400
3750IFERR=19ANDERL=2750 sheet$(I%,J%)="("+sheet$(I%,J
%):GOTO400
3760sheet$(I%,J%)="\"+sheet$(I%,J%):GOTO400
```

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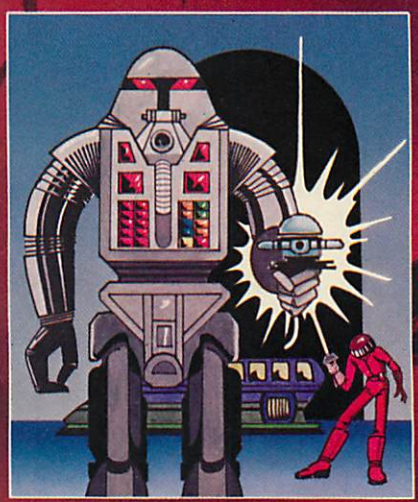
"Alien Intruder/Hieroglyphics — Both programs make good use of graphics and words to make a very entertaining package." (Sinclair User, Aug '82)

"Alien/Hieroglyphics/Wumpus/Movie — A varied mix from Carnell, all featuring imaginative responses and graphics and all of them good games for all ages (Hieroglyphics is particularly good for children)." (Popular Computing Weekly, Aug '82)



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An exciting, fast moving, machine code, arcade game where you guide your intrepid St. Bernard through the perils of the icy wastelands to rescue his Mistress from the clutches of the abominable snowman.



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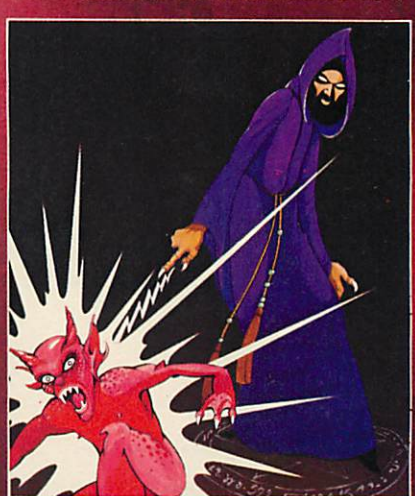
THE CRYPT

written by Stephen Renton

Prepare yourself for the many challenges that shall confront you when you dare to enter "THE CRYPT".

You will battle with giant scorpions, Hell spawn, Craners, Pos-Negs and if you are unlucky enough — the Dark Cyclops in this arcade style adventure.

Available now for the 48K Spectrum @ £4.95



THE DEVIL RIDES IN

I uttered the last incantations as the clock struck thirteen. All fell silent except for a faint rustling in the corner. From out of the shadows they came, all Hell's fury against me but I was not defenceless until the Angel Of Death, astride a winged horse, joined the battle. Avoiding his bolts of hell fire, I took careful aim. My chances were slim, but if my luck held . . .

(Fast moving, machine code, all action, Arcade game)

RANGE FROM CARNELL SOFTWARE



"THE WRATH OF MAGRA"

The first born has been destroyed. The Black Crystal of Beroth has been banished. The alliance of Evil has been defeated by the armies of Lord Fendal. So ends the Third Age. Now we invite you to write your name in the history of the Fourth Age of the Third Continent.

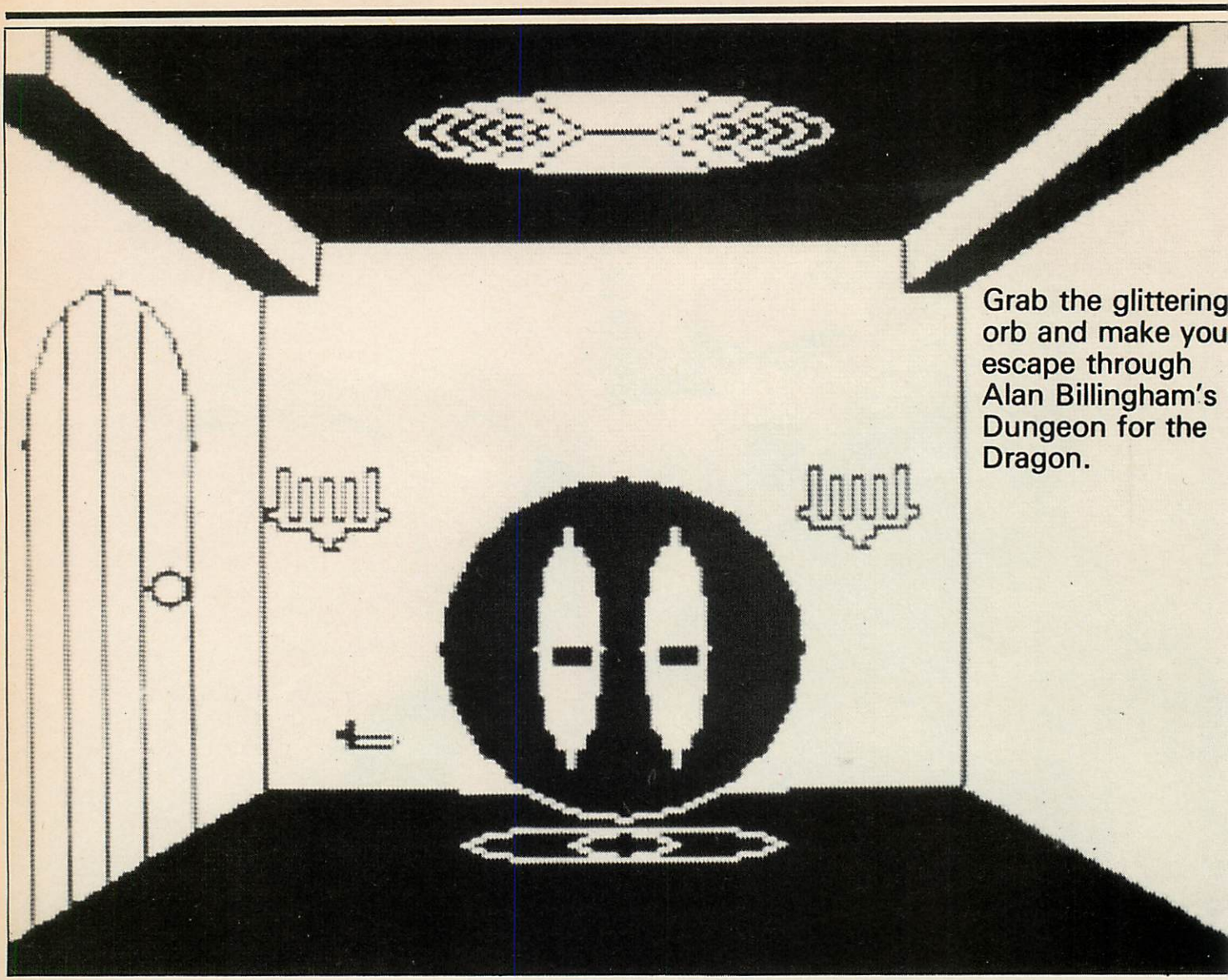
You will meet friends and enemies, old and new, in the long awaited sequel to Volcanic Dungeon. Using high resolution graphics and combining the best qualities of "Black Crystal" and "Volcanic Dungeon", we will allow you to become part of this tale of revenge.

"The Wrath Of Magra" comes as three, 48K programs on cassette, boxed with instruction manual and book detailing the history of the Third Continent and the many spells you will be using throughout the game.

NOTE: "The Wrath Of Magra" is a complete adventure. You need not buy "Volcanic Dungeon" or "Black Crystal" to play it.

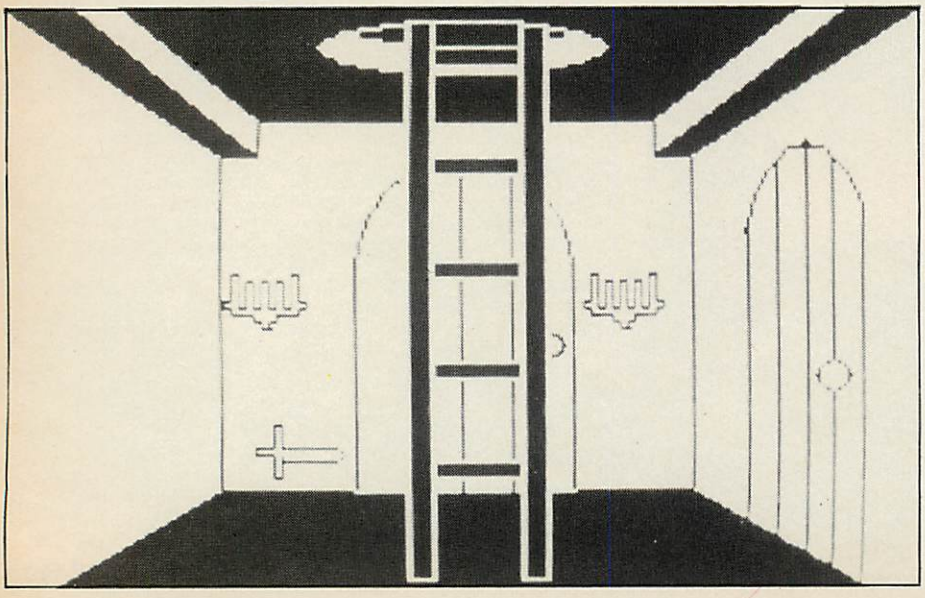
Available through most good computer stores or direct from:
Carnell Software Ltd, North Weylands Industrial Estate, Molesey Road, Hersham, Surrey KT12 3PL.
Dealers: Contact us for your nearest wholesaler.

CARNELL SOFTWARE LTD



Grab the glittering orb and make you escape through Alan Billingham's Dungeon for the Dragon.

DUNGEON



THE OBJECT OF this game is to search for and escape with the great orb which is glittery. To prevent you escaping with the orb there are several types of odd looking creatures all set on your demise. During your search for the orb you may protect yourself from the creatures of the dungeon by collecting swords and daggers. The following bonuses are achieved for weapons:

no weapon	– 10% of your strength.
dagger	– 100 added to attack bonus.
sword	– 200 added to attack bonus.

At any time you may carry approximately three weapons depending on your strength. At any time you may increase your strength by opening and maybe finding a strength potion – this is indicated by a flashing screen.

Each room is drawn on 3D-hires showing the contents. You start by a ladder coming down from the roof in a room containing a light and a sword/dagger. To move you push the right joystick in the direction required.

Listing for Dragon Dungeon.

```
2  POKE65495,0
3 CLEAR 1000
4 NN=0
5 PCLEAR8
6 PMODE 4,1:PCLS:CLS
8 DIM R(100,5)
9 CLS
10 PRINT@160,"          D U N G E O N "
11 PRINT@224,"                  BY"
12 PRINT@288 ,"          A.R.BILLINGHAM"
13 GOSUB 247' INITIALIZE ROOMS
14 PLAY"T100;01;2;3;4;5;6;7;8;9;10;11;12;02;1;2;3;4;5;
6;7;8;9;10;11;12;03;1;2;3;4;5;6;7;8;9;1;11;12;04;1;2;3
;4;5;6;7;8;9;10;11;12;05;1;2;3;4;5;6;7;8;9;10;11;12"
15 ST=990
16 GOSUB 90'DRAW ROOM
17 IF MH>0 THEN GOSUB 330
18 GOTO23
19 IF CO=1 THEN DG=0:SW=0
20 IF CO THEN ST=ST+10
21 IF ST<=0 THEN GOTO 375
22 GOTO 17
23 'GET COMMANDS
24 REM "N=1 E=2 W=3 S=4"
25 DX=JOYSTK(0):DY=JOYSTK(1)
26 DD=0
27 IF DX<10 AND DY>10ANDDY<50 THEN DD=3
28 IF DX>50 AND DY>10ANDDY<50 THEN DD=2
29 IF DY<10 AND DX>10 AND DX<50 THEN DD=1
30 IF DY>50 AND DX>10 AND DX<50 THEN DD=4
31 IF R(PP,DD)=0 THENDD=0
32 Q$=INKEY$
33 PE=PEEK(65280):IF PE=126 OR PE=254 THEN Q$="G"
34 IF Q$="" AND DD=0 THEN 25
35 IF Q$<>""THENGOTO 39
36 IF DD=0 THEN 25
37 IF R(PP,DD)<>0 THEN RT=ABS(R(PP,DD))
38 GOTO 81
39 IF Q$="L" AND LG=0 AND LI=0 THEN 19
40 IF Q$="L" AND LG=1 AND LI=1 THEN19
41 IF Q$="L" AND LG=1 AND LI=0 THEN LG=0:R(PP,5)=R(PP,
5)+1000000
42 IF Q$="L"AND LG=0 AND LI=1 THEN LG=1:R(PP,5)=R(PP,5
)-1000000
43 IF Q$="L"THEN GOSUB90
44 IFQ$="K" AND KH=0ANDKY=0THEN25
45 IFQ$="K"ANDKH=1ANDKY=1 THEN25
46 IF Q$="K" AND KY=1 AND KH=0 THEN R(PP,5)=R(PP,5)+10
000:KY=0
47 IF Q$="K"AND KY=0 AND KH=1 THEN R(PP,5)=R(PP,5)-100
00:KY=1
48 IF Q$="K" THEN GOSUB 90
49 IF Q$="S"AND KY=0 THEN 25
50 IF Q$<>"S" THEN 58
51 DX=JOYSTK(0):DY=JOYSTK(1)
52 IF DX<10 THEN R(PP,3)=ABS(R(PP,3)):R(ABS(R(PP,3)),2
)=PP
53 IF DX>50 THEN R(PP,2)=ABS(R(PP,2)):R(ABS(R(PP,2)),3
)=PP
54 IF DY<10 THEN R(PP,1)=ABS(R(PP,1)):R(ABS(R(PP,1)),4
)=PP
55 IF DY>50 THEN R(PP,4)=ABS(R(PP,4)):R(ABS(R(PP,4)),1
)=PP
56 O=PEEK(65280):IF O=126 OR O=254 THEN 57 ELSE 51
57 GOSUB 90
58 IF Q$<>"O"THEN 67
59 IF Q$="O"ANDKY=0THEN25
60 DX=JOYSTK(0):DY=JOYSTK(1)
61 IF DX<10 THEN R(PP,3)=-ABS(R(PP,3)):R(ABS(R(PP,3)),
2)=-PP
62 IF DX>50 THEN R(PP,2)=-ABS(R(PP,2)):R(ABS(R(PP,2)),
3)=-PP
63 IF DY>50 THEN R(PP,4)=-ABS(R(PP,4)):R(ABS(R(PP,4)),
1)=-PP
64 IF DY<10 THEN R(PP,1)=-ABS(R(PP,1)):R(ABS(R(PP,1)),
4)=-PP
65 O=PEEK(65280):IFO=126 OR O=254 THEN 66 ELSE60
66 GOSUB 90
67 IF Q$="G" AND OH>0 AND CH=1 AND EE=0 THEN GOSUB 392
:GOSUB 90
68 IF Q$="G"AND SW+DG>3 THEN19
69 IF Q$="G"AND CO=1 THEN 19
70 IFQ$="G"AND, OH=0 AND EE=0 THEN 19
71 IF Q$="G" AND OH=1 AND CH=1 AND EE=0 THEN 19
72 IF Q$="G" AND OH=1 AND CH<>1  THEN SW=1+SW :R(PP,5)
=R(PP,5)-1000
73 IF Q$="G" AND OH=2 AND CH<>1  THEN DG=1+DG:R(PP,5)=
R(PP,5)-2000
74 IF Q$="G" THEN 78
75 IF Q$=" " THEN PP=RND(100):KY=0:LG=0:SW=0:ST=ST-100
:DG=0:GOSUB90:FOR I=1 TO 20:SCREEN1,0:SCREEN1,1:NEXT I
:GOTO19
76 IF Q$="X"AND CO=0 THEN 19
77 IF Q$="X"AND CO=1 THEN 375
78 IF Q$="G"AND  EE=1 THEN CO=1:R(PP,5)=R(PP,5)-100:GO
SUB 90:GOTO19
79 IF Q$="G" THEN GOSUB 90
80 GOTO19
81 'ABBOUT TO ENTER RT
82 'PRESENT ROOM PP
83 IF INT(R(RT,5)/1000000)=0 AND LG=0 THEN GOTO25
84 IF R(PP,DD)>0 AND KY=0 THEN 25
85 R(RT,5-DD)=-ABS(R(RT,5-DD))
86 PP=RT
87 ST=ST-10
88 GOSUB 90
89 GOTO 19
90 CLS0
91 SCREEN1,1
92 GOSUB 123
93 IF SGN(R(PP,1))=1THEN GOSUB 176 ' FDSHUT
94 IF SGN(R(PP,1))=-1 THEN GOSUB 158 'FDOPEN
95 IF SGN(R(PP,2))=1 THEN GOSUB 182
96 IF SGN(R(PP,2))=-1 THEN GOSUB 193
97 IF SGN(R(PP,3))=1 THEN GOSUB 201
98 IF SGN(R(PP,3))=-1THEN GOSUB 212
99 RY=R(PP,5)
100 MH=INT(RY/10000000)
101 RY=RY-MH*10000000
102 LI=INT(RY/1000000)
103 RY=RY-1000000*LI
104 CH=INT(RY/100000)
105 RY=RY-100000*CH
106 KH=INT(RY/10000)
107 RY=RY-10000*KH
108 OH=INT(RY/1000)
109 RY=RY-OH*1000
110 EE=INT(RY/100)
111 RY=RY-100*EE
112 EX=INT(RY/10)
113 RY=RY-10*EX
114 EN=RY
115 IF LI=1 THEN GOSUB 222
116 IF CH=1 THEN GOSUB 227
117 IF KH>0THEN GOSUB242
118 IF OH>0 THEN GOSUB 284
119 IF EX=1 THEN GOSUB  291
120 IF EN=1 THEN GOSUB 302
121 IF EE=1 THEN GOSUB  318
122 RETURN
123 'DRAW ROOM
124 IF NN>0 THEN FOR I=5 TO 8:PCOPY I TO (I-4):NEXTI:R
ETURN
125 PMODE4,1
126 PCLS1
127 COLOR0,1
128 LINE (0,0)-(252,189),PSET,B
129 LINE(0,10)-(60,50),PSET
130 LINE(20,10)-(0,10),PSET
131 LINE(20,10)-(70,50),PSET
132 LINE(70,50)-(60,50),PSET
133 LINE(20,0)-(20,10),PSET
134 LINE(70,50)-(70,40),PSET
135 LINE-(20,0),PSET
136 LINE(70,40)-(179,40),PSET
137 LINE-(232,0),PSET
138 LINE(0,189)-(60,149),PSET
139 LINE-(60,50),PSET
140 LINE(252,189)-(189,149),PSET
141 LINE-(60,149),PSET
142 LINE(189,149)-(189,50),PSET
143 LINE(232,0)-(232,10),PSET
144 LINE-(252,10),PSET
145 LINE(179,40)-(179,50),PSET
146 LINE-(232,10),PSET
147 LINE(179,50)-(189,50),PSET
148 LINE-(252,10),PSET
149 PAINT(10,13),0,0
150 PAINT(150,13),0,0
151 PAINT(235,12),0,0
152 FOR I=40 TO 10 STEP -5
153 CIRCLE(126,20),I,1,0.2
154 NEXTI
155 PAINT(126,187),0,0
156 IF NN=0 THEN NN=NN+1:FOR I=1 TO 4:PCOPY I TO (I+4)
:NEXT I
157 RETURN
158 '  FORWARDS DOOR OPEN
159 GOSUB 160:GOTO165
160 LINE(96,80)-(96,149),PSET
161 LINE(156,80)-(156,149),PSET
162 LINE(96,149)-(156,149),PRESET
163 CIRCLE(126,80),30,0,1,0.5
164 RETURN
165 LINE(96,149)-(125,139),PSET
166 LINE-(125,70),PSET
167 CIRCLE(97,70),29,0,1,.9,1
168 LINE(106,145)-(106,58),PSET
169 LINE(115,143)-(115,54),PSET
170 CIRCLE(125,100),4,0
171 LINE(125,65)-(150,65),PSET
172 PAINT(130,63),0,0
173 LINE(125,130)-(155,130),PSET
174 PAINT(130,140),0,0
175 RETURN
176 GOSUB 160
177 LINE(110,149)-(110,56),PSET
178 LINE(125,149)-(125,51),PSET
179 LINE(139,149)-(139,55),PSET
180 CIRCLE(150,105),4
181 RETURN
182 GOSUB 183:GOTO187
183 LINE(204,172)-(204,70),PSET
184 LINE(235,180)-(235,65),PSET
185 CIRCLE(220,82),18,0,2,0.55,0.93
186 RETURN
187 LINE(220,180)-(220,47),PSET
188 LINE(212,180)-(212,52),PSET
189 LINE(227,180)-(227,52),PSET
190 CIRCLE(227,115),5,0
191 LINE(227,119)-(227,111),PRESET
192 RETURN
193 GOSUB 183
194 LINE(205,158)-(235,158),PSET
195 CIRCLE(223,070),20,0,1,.5,.79
196 PAINT(220,50),0,0
197 PAINT(220,160),0,0
198 LINE(217,180)-(217,50),PSET
199 LINE(227,180)-(227,50),PSET
200 RETURN
201 REM'LEFT DOOR
202 GOSUB203:GOTO207
203 LINE(17,180)-(17,75),PSET
204 LINE(47,180)-(47,75),PSET
205 CIRCLE(32,80),16,0,2,0.5,1.05
206 RETURN
207 LINE(24,180)-(24,55),PSET
208 LINE(31,180)-(31,50),PSET
209 LINE(38,180)-(38,54),PSET
210 CIRCLE(43,108),4,0
211 RETURN
212 ' LEFT DOOR OPEN
213 GOSUB 203
214 LINE(42,75)-(42,157),PSET
215 LINE-(47,157),PSET
216 CIRCLE(27,80),16,0,2,0.8,1.05
217 LINE(42,130)-(17,130),PSET
218 PAINT(30,140),0,0
219 LINE(40,65)-(18,65),PSET
220 PAINT(30,64),0,0
221 RETURN
222 REM LIGHT
223 L$="S2;L2U4L4U4L12U4L4U4R4U16R2U1D1R2D20R4U16R2U1D
1R2D16R4U16R2U1D1R2D16R4U16R2U1D1R2D16R4U20R2U1D1R2D16
R4D4L4D4L12D4L4D4R2"
224 DRAW"C0;BM170,100;"+L$
225 DRAW"C0;BM72,100;"+L$
226 RETURN
227 REM'CHEST
228 LINE(50,135)-(83,155),PRESET,BF
229 LINE(50,135)-(83,155),PSET,B
230 LINE(83,155)-(94,148),PRESET
231 CIRCLE(56,135),7,0,2,0.5,0.75
232 CIRCLE(89,135),7,0,2,.5,1
233 LINE(94,148)-(94,132),PSET
234 PAINT(90,135),0,0
235 LINE(66,135)-(60,117),PRESET
236 LINE(55,121)-(90,121),PSET
237 CIRCLE(62,135),7,0,2,.5,.75
238 CIRCLE(68,135),7,0,2,.5,.75
239 CIRCLE(74,135),7,0,2,.5,.75
240 CIRCLE(80,135),7,0,2,.5,.75
241 RETURN
242 ' KEY
243 K$="S2H10E10F10G10D20L2R2D2L2R2D2L4"
244 DRAW"BM12,60;"+K$
245 DRAW"BM244,60;"+K$
246 RETURN
247 REM INITIALIZATION
248 FOR I=1 TO 85
249 PLAY"T100;03;V10;L1;A"
250 FOR D=1 TO 2
251 RO=RND(100)
252 DR=RND(3)-2
253 RO=RO*DR
254 IF R(ABS(RO),5-D)<>0THEN251
255 IF ABS(RO)=1 THEN 251
256 R(I,D)=RO*DR
257 R(ABS(RO),5-D)=I*DR
258 NEXTD
259 R(I,5)=(RND(2)-1)*1000000+(RND(2)-1)*100000+(RND(3
)-1)*1000
260 IF RND(100)<20 THEN R(I,5)=R(I,5)+(RND(3)*10000000
)
262 NEXTI
263 PP=RND(75)
264 DR=RND(4):IF R(PP,DR)>=0 THEN 263
265 R(ABS(R(PP,DR)),5)=R(ABS(R(PP,DR)),5)+10000
266 R(PP,5)=1001001
267 KY=0'NO KEY
268 LG=0'NO LIGHT
269 SW=0'NO SWORD
270 DG=0'NO DAGGER
271 FOR I=1 TO 70
272 O=RND(100):IF O=PP THEN 272
273 R(O,5)=10000
274 NEXTI
275 EX=RND(100):DR=RND(4)
276 IF R(EX,DR)=0 THEN 275
277 IF EX=PP THEN 275
278 R(EX,5)=R(EX,5)+10
279 RO=RND(100):DR=RND(4)
280 IF R(RO,DR)=0 THEN 279
281 IF RO=PP OR RO=EX THEN 279
282 R(RO,5)=R(RO,5)+100
283 RETURN
284 'OBJECT IN ROOM
285 IF CH=1 THEN RETURN
286 S$="S2;C0;R30E5H5L30U15L5D15L10D5R10D15R5U15"
287 D$="S2;C0;R15E3H3L15D5L2U5L5U2R5U5R2D5"
288 IF OH=1 THEN DRAW"BM76,140;"+S$
289 IF OH=2 THEN DRAW"BM76,140;"+D$
290 RETURN
291 ' DRAW EXIT
292 CIRCLE (126,170),40,1,0.2
293 PAINT(126,170),1,1
294 CIRCLE(126,180),40,0,0.2
295 PAINT(126,174),0,0
296 CIRCLE(126,170),40,1,.2
297 LINE(110,150)-(117,176),PSET,BF
298 LINE(110,150)-(117,176),PRESET,B
299 LINE(142,150)-(149,176),PSET,BF
300 LINE(142,150)-(149,176),PRESET,B
301 RETURN
302 ' DRAW ENTRANCE
303 LINE(78,0)-(180,39),PSET,BF
304 CIRCLE(126,20),40,1,.2
305 PAINT(120,20),1,1
306 CIRCLE(126,12),40,0,.2,.6,.4
307 PAINT(126,14),0,0
308 CIRCLE(126,20),40,1,.2
309 LINE(110,13)-(117,176),PSET,BF
310 LINE(142,14)-(149,176),PSET,BF
311 LINE(142,14)-(149,176),PRESET,B
312 LINE(110,13)-(117,176),PRESET,B
313 FOR I=20 TO 160 STEP 30
314 LINE(117,I)-(142,I+5),PSET,BF
315 LINE(117,I)-(142,I+5),PRESET,B
316 NEXTI
317 RETURN
318 '  FOUND ORB
319 LINE(121,130)-(141,166),PSET,BF
320 LINE(141,130)-(141,166),PRESET
321 LINE(111,140)-(131,176),PRESET,BF
322 LINE(111,140)-(131,176),PSET,B
323 LINE(131,176)-(141,166),PRESET
324 FOR T=1 TO 3
325 FOR I=20 TO 1 STEP -1
326 CIRCLE(126,125),I,RND(2)-1
327 NEXT I
328 NEXT T
329 RETURN
330 ' FIGHT MONSTER
331 MS=1000+INT(RND(ST))
332 'DRAW MONSTER IN CENTRE OGF ROOM
333 LINE(96,50)-(156,149),PRESET,BF
334 ON MH GOSUB 336,399,420
335 GOTO349
336 CIRCLE(126,120),35,0
337 PAINT(126,120),0,0
338 CIRCLE(126,120),35,1
339 CIRCLE(116,120),6,1,4
340 CIRCLE(136,120),6,1,4
341 PAINT(136,120),1,1
342 PAINT(116,120),1,1
343 CIRCLE(116,160),20,1,.2
344 CIRCLE(136,160),20,1,.2
345 LINE(113,120)-(120,123),PSET,BF
346 LINE(133,120)-(140,123),PSET,BF
347 PAINT(116,160),1,1:PAINT(136,160),1,1
```

(listing continued on page 121)

DRAGON 32

To move into a dark room you must have a light — if a door is open and you cannot go through then you have no light and the room is dark. To move through a locked door you must have a key. To climb down the exit ladder you must have the orb.

The orb is very delicate and you need both hands to support it — this means that you cannot pick up or use weapons.

Commands.

k takes key or puts it down.

l takes light or puts it down.

g gets orb, food or weapon.

o opens doors: Move joystick successively to the door/doors you wish to shut, when ready press the fire button.

f shuts doors: as opens — o.

x exits down ladder when carrying the orb.

Space is the hyperspacer/panic bar, when you get stuck this is your only option but use cautiously as it uses strength up rapidly.

The joystick moves you forward, left, right or back. The joystick fire button duplicates the g key for ease of use. If you defeat the monsters your weapons will dissolve leaving you defenceless, so preserve your weapons as their supply is limited. During the fight you may drop or lose your key or light — if dropped they will just reappear in the room.

Each location is represented by a variable R (X,Y)

R(LOCATION, 1) = door north (forwards)
R(,, 4) = door south (backwards)
R(,, 2-3) = left and right
R(,, 5) = describes the room and the contents.

A negative location is R(Location, 1-4) is an open door.

A positive is an open door and zero is no door.

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Access

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2) Rotation about a line between two points.
3) Generation of stereo pairs.
4) View from one point towards another point.

Objects can be stored separately on tape and copied to the ZX printer.
Written in BASIC for you to modify to your own requirements.
Ideal for computer modelling, molecular modelling, CAD etc.

Viewpoint - with full instruction and examples
£6.50

Just starting to write machine code programs? The ideal assembler for beginners is Ultraviolet. Look at the facilities that it offers:

Works entirely in decimal (no hex problems); all Z80 instructions correctly assembled; supports the pseudo-instructions EQU, ORG (multiple ORGs allowed), DEFB, DEFW and DEFS; code can be assembled at one location and then relocated; allows alphanumeric labels of any length; full listings of assembled code and mnemonics can be output to the printer; full error trapping with faulty instruction clearly indicated; comments can be included in the source file.

The ideal complement to Ultraviolet is Infrared - an easy-to-use disassembler.

So now there is no need to be intimidated by machine code - with Ultraviolet and Infrared it's child's play! Buy them from the machine code specialists - ACS Software.

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(Patent Pending)

ZAP

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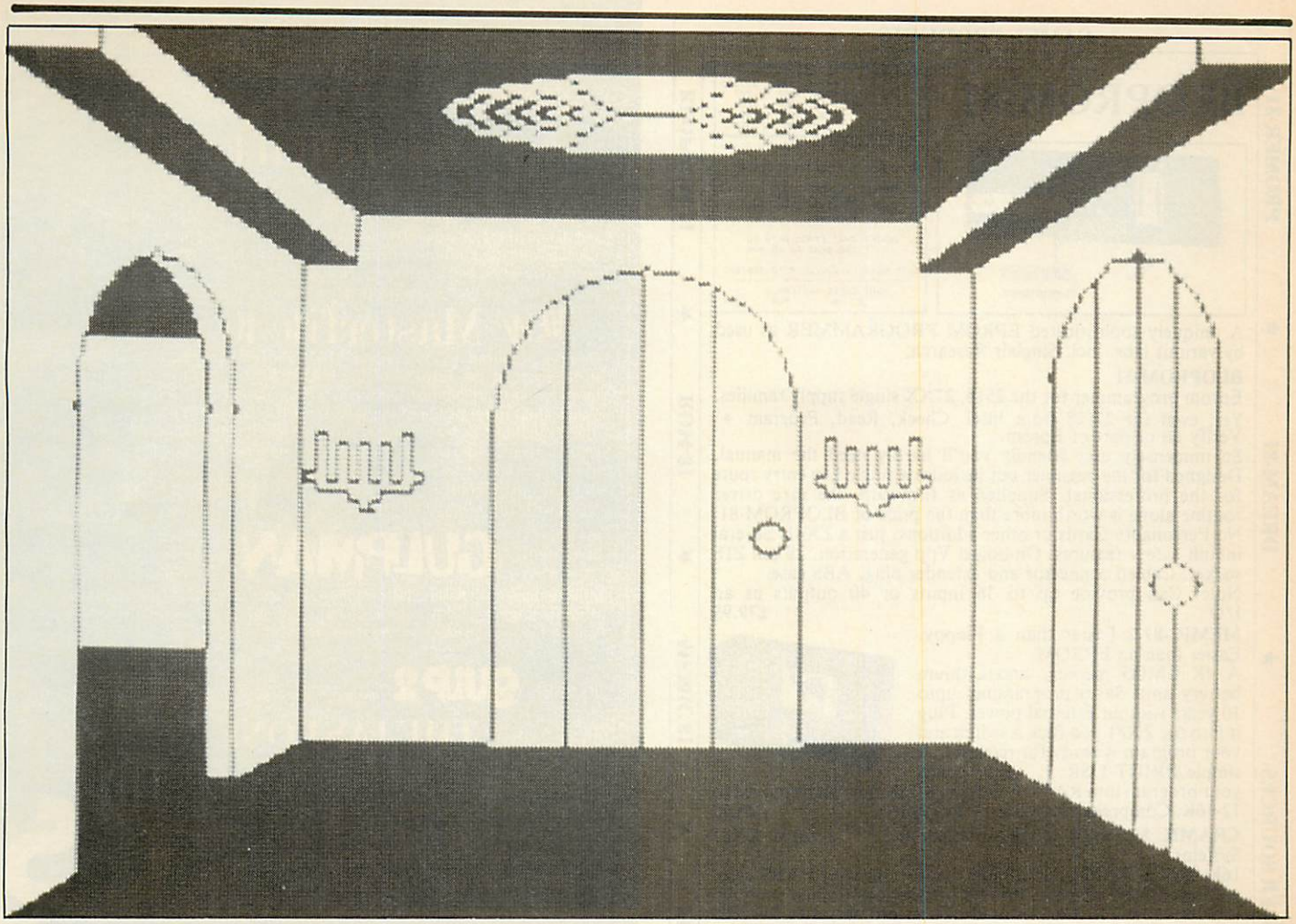
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COMPUSOUND

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(listing continued from page 119)

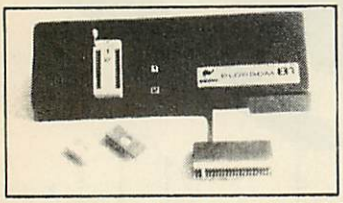
```
348 RETURN
349 IF INKEY$=""THEN349
350 CLS
351 AT=INT(ST/10)
352 AT=AT+CO*100
353 AT=AT+SW*200
354 AT=AT+DG*100
355 IF MS>ST THEN AT=AT+INT(RND(MS-ST)/20)
356 CLS
357 PRINT@32, "YOUR STREGNTH=";ST
358 PRINT@64  ,"YOUR MAX DAM =";AT
359 DA=INT(RND(AT))
360 PRINT@96,"YOUR DAMAGE  =";DA
361 MS=MS-DA
362 PRINT@256,"MONSTER STREGNTH=";MS
363 DM=INT(MS/11)
364 IF ST>MS THEN DM=DM+RND(INT(ST-MS)/20)
365 PRINT@288,"MAX MONSTER DAM =";DM
366 DT=INT(RND(DM)):PRINT@320,"MONSTER DAMAGE  =";DT:S
T=ST-DT
367 IF MS<=0 AND RND(50)<5 THEN KY=0
368 IF MS<=0 AND RND(100)<5THEN LG=0
369 IF MS<=0 THEN ST=ST+500+RND(500):DG=0:SW=0:R(PP,5)
=R(PP,5)-(MH*10000000):MH=0:GOSUB 90:RETURN
370 IF ST<=0 THEN GOSUB 90:RETURN
371 FOR Y=1 TO 300:NEXTY
373 GOTO351
374 RETURN
375 ' OUT
376 PCLS0
377 PMODE4,1
378 SCREEN 1,1
379 LINE(0,96)-(255,192),PSET,BF
380 FOR I=0 TO 300:PSET(RND(252),RND(96),1):NEXTI
381 FOR I=0 TO 252 STEP 40:LINE(126,96)-(I,192),PRESET
:NEXTI
382 IF ST<=0 THEN LINE(160,50)-(210,150),PSET,BF:LINE(
160,50)-(160,150),PRESET:LINE(210,50)-(210,150),PRESET
:LINE(160,150)-(210,150),PRESET:CIRCLE(185,50),25,1:PA
INT(175,40),1,1:CIRCLE(185,50),25,0,1,.5,1
383 IF ST<=0 THEN CIRCLE(175,45),25,1,1,.8
384 IF ST<=0 THEN DRAW"BM175,80;S8;C0;U4R2D2L2F2"
385 IF ST<=0 THEN DRAW"BM185,80;S8;C0;R1L2R1U4R1L2R1"
386 IF ST<=0 THEN DRAW"BM192,80;S8;C0U4R2D2L2S4"
387 IF ST<=0 THEN DRAW"BM185,100;U4R2D4R4D2L4D10L2U10L
4U2R4U4"
388 IF CO=1THEN GOSUB 318
389 Q$=INKEY$:IF Q$=""THEN389
390 IF Q$="S"THEN CLS:POKE65494,0:END
391 RUN
392 REM 'FOOD FOUND
393 IF OH=1 THEN ST=ST+RND(500)
394 IF OH=2 THEN ST=ST+RND(1000)
395 FOR I=1 TO 50:SCREEN1,1:SCREEN1,0:SCREEN1,1:NEXTI
396 R(PP,5)=R(PP,5)-100000
397 R(PP,5)=R(PP,5)-(OH*1000)
398 RETURN
399 'MONSTER2
400 CIRCLE(126,120),35,0
401 PAINT(126,120),0,0
402 CIRCLE(126,120),35,1
403 CIRCLE(96,80),20,0:PAINT(96,80),0,0
404 CIRCLE(156,80),20,0:PAINT(156,80),0,0
405 CIRCLE(96,80),15,1,0.5
406 CIRCLE(156,80),15,1
407 PAINT(96,80),1,1:PAINT(156,80),1,1
408 CIRCLE(96,80),2,0,6
409 CIRCLE(156,80),2,0,6
410 PAINT(96,80),0,0
411 PAINT(156,80),0,0
412 CIRCLE(126,130),30,1,.5
413 PAINT(126,130),1,1
414 FOR L=0.001 TO 0.5 STEP .07
415 CIRCLE(126,130),25,0,L
416 NEXT L
417 LINE(120,155)-(132,170),PRESET,BF
418 CIRCLE(126,170),10,1,0.4
419 RETURN
420 REM MONSTER 3
421 LINE(126,70)-(126,170),PSET
422 LINE(76,120)-(176,120),PSET
423 LINE(176,70)-(76,170),PSET
424 LINE(76,70)-(176,170),PSET
425 CIRCLE(126,120),1,1
426 CIRCLE(126,120),2,1
427 CIRCLE(126,120),20,0
428 PAINT(128,130),0,0
429 CIRCLE(126,120),15,1,0.5
430 PAINT(126,120),1,1
431 CIRCLE(126,120),5,0
432 PAINT(126,120),0,0
433 CIRCLE(126,115),15,1,0.5,.6,.95
434 CIRCLE(126,114),15,1,0.5,.6,.95
435 RETURN
```

CAMEL PRODUCTS

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BLOPROM-81 ★ ROM-81 ★ MEMIC 81 ★ PIO-81 ★ PIO-SP ★ MEMIC-81 ★ CRAMIC-81

BLOPROM-81



```
STATUS )     NO. SYSTEM - HEX
       )          EPROM TYPE - 27128
       ) RAM START ADDR - 4000
       ) EPROM ST. ADDR - 0000
       )      JOB LENGTH - 4000
       )            TASK - CHECK

WHICH TASK DO YOU WISH TO DO ?

W) CHECK   THAT EPROM IS CLEAN

X) READ    THE CONTENTS OF
           EPROM INTO RAM
Y) BLOW    AN EPROM WITH DATA
           FROM RAM

Z) VERIFY THAT EPROM DATA IS
          THE SAME AS IN RAM

Q TO QUIT.....A TO RESTART

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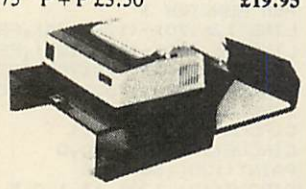
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ORIC INVADERS

THIS IS A VERSION of Space Invaders written for the 48K Oric 1. The game is played in text mode, using Oric's user-defined characters to create the effect of high resolution.

The program consists of two sections. The machine code must be entered first, using the short Basic routine in listing 2. When all the machine code has been typed in you should type

NEW (RETURN)

to get rid of the small Basic routine.

After typing in all these numbers you may not wish to type in the Basic part of the program — in listing 1 — straight away. Therefore, if you wish to Save the machine code at this point type:

CSAVE "MC", A# D00, E# 1403 (RETURN)

Then type:

CLOAD "MC", A# D00, E# 1403 (RETURN)

when you wish to load it back.

When you have entered the Basic program it is essential that you Save the whole program on cassette before you Run it in case there are any errors in the machine code. To Save the program type:

POKE# 9C, # 1405 (RETURN)

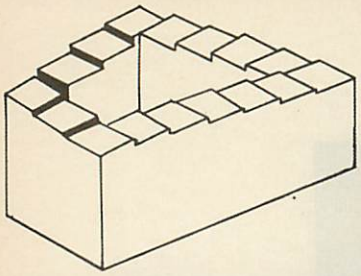
CSAVE "INVADERS", AUTO (RETURN)

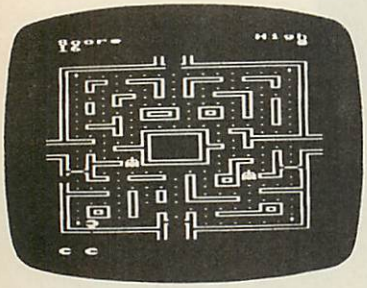
This will Save the machine code after the Basic program and will Run the program when it is CLoaded.

The game consists of three different types of invaders, worth 100, 50 and 30 points, and a blue ship which occasionally shoots across the top of the screen worth 500 points. The controls are as follows:

Cursor left — Move left
Cursor down — Move right
Space-bar — Fire

(continued on page 125)







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BRITAIN'S LARGEST SINGLE-MICRO USER GROUP

MEMBERSHIP NOW EXCEEDS 20,000

20,000 members can't be wrong — **BEEBUG** provides the best support for the BBC Micro. **BEEBUG** Magazine — now 64 pages including new product guide supplement — devoted exclusively to the BBC Micro, Programs — Hints & Tips — Major Articles — News — Reviews — Commentary. **PLUS** members discount scheme with National Retailers. **PLUS** members Software Library. 10 Magazines a Year. First issue April 1982. Reprints of all issues available to members.

August/September Issue — GAMES — Space Lords (32K) a two-player space battle, and Mars Lander (16K). Build Yourself a Light Pen — simple explanation for the beginner, together with a sample program. Use our "Contact Points for the Beeb" to discover who to contact when in need. We show how to put those 'awkward' cassette programs onto disc. Final installment of our popular 5-part series on "Using Files". REVIEWS of — MICRONET, Watfords Electronic's Disc Filing System, two EPROM programmers, and the tax advisory package "Microtax" This month's visual programs include Spider's Web, Super Large Screen Characters, Bounce and Swing. We also show how to hold two complete screen pictures at once, and switch rapidly between them in "Dual Screens on the Beeb". A Crossword, Brain Teaser and our 4th Software Competition provide a competitive edge to this month's magazine. We also have our very popular scattering of Hints and Tips.

October Issue — GAMES — **Munch-Man**, a Snapper type game with super graphics, Illusions graphics and sound you won't believe. A Versatile **Renumber** program for Basic, **Fabric Patterns**, an invisible **Alarm Clock, Disc Sector String Search** and a program fro drawing **3D Surfaces.** Articles on the **Teletext Mode** for beginners, **Compilers and Interpreters,** using **Joysticks**, using the **Speech Synthesizer** and more. Reviews of two **Cassette Recorders** (Marantz Superscope C190 and Acorn Data Recorder), three **Printers** (NEC pc-8023B, Star DP840 and CP-80), and lots of new games software (and we've arranged **SPECIAL OFFERS** for members). Plus a review of the new **Acorn Electron** and news of our new magazine for Electron users called **ORBIT.** Plus all our usual features like Hints and Tips, Postbag, and a new Brainteaser.

STOP PRESS
BEEBUG has negotiated a deal with ACORN over the new 1.2 OPERATING SYSTEM ROM. BEEBUG members are offered the ROM at around half-price. See BEEBUG Feb. Issue for details.

SOFTWARE DETAILS
BEEBUGSOFT: BEEBUG SOFTWARE LIBRARY
offers members a growing range of software from £3.50 per cassette. 1. Starfile (32K). 2. Moonlander (16K). 3D Noughts and Crosses (32K). 3. Shape Match (18K). **Mindbinder** (16K). 4. Magic Eel (32K). 5. Cylon Attack (32K). 6. Astro-Tracker (32K). **Utilities:** 1. Dissembler (16K). Redefine (16K). Mini Text Ed (32K). **Applications:** 1. Superplot (32K). 2. Masterfile (32K).

Magazine programs now available on cassette to members at £3.50 inc: VAt & p+p — see April/May issue for details.

13% DISCOUNT TO MEMBERS ON THE EXCELLENT WORDWISE WORD PROCESSING PACKAGE — THIS REPRESENTS A SAVING OF OVER £5.00.

Send £1.00 for SAE for Samole
membership: UK £5.40 for six months, £9.90 for one year
Overseas one year only: Europe £16.00, Middle East £19.00, Americas & Africa £21.00. Other Countries £23.00
Make cheque to BEEBUG Dept 4, 374 Wandsworth Rd. London SW3 4TW
For editorial material send to: The Editor, BEEBUG, PO Box 50, St Albans, Herts AL1 2AR

ORIC – 1

VANQUISHER (48K)
All the excitement of the Railway on your micro. You will be the respected Station master of Vanquisher Junction, and your judgement and problem solving ability will have to see you through.
£5.20 at good Software Stations.

RINGO (16K)
You have been set the problem of the RINGS by the keeper of TIME. The meaning of LIFE, TIME, and EVERYTHING depends on you now. Do not be detered there is a solution to the riddle of the RINGS.
£5.00 at local Software Keepers.

PARAGRAM (16K)
After you've Fractured your Finger on the invaders — try paragram, and Bust your Brains beyond repair. Blocks within blocks of your favourites — the letters of the alphabet.
£5.50 at local Software Surgeons.

JERICO 2 (48K)
You are Joshua, in search of the lost 'H'. You have your band of followers to help you. On your quest, you have laid siege to the walled city, and you must win, but this time you don't have the Trumpet.
£5.95 at Army Surplus Software Stores.

FARMER HORACE (16K)
Horace has been jailed for TEN years you have promised him you would look after the Farm. You must make a Profit and not starve the workers, or you'll find yourself in Jail for TEN years, with Horace.
FREE WITH JERICO 2.

PARAGRAM (48K) £6.00



JERICO 2 (48K) £6.95



VANQUISHER (48K) £6.50



RINGO (48K) £6.50



Wholesale Distribution by P.C.S.

SPECTRUM



Elephant Software.



41 Haymill Rd Burnham Berkshire SL1 6NE

NEW

For use with DRAGON 32 computer

The complete speech synthesis system

SPEECH SYNTHESIS MODULE
for the Dragon 32 Computer

- Fully cased module plugs into cartridge port
- Unlimited vocabulary; based on dedicated speech processor utilising allophones
- Approx 200 words, and all numbers, pre-defined, for access by entering word or number required
- Complete control using 5 new BASIC commands
- Speech can easily be incorporated into existing BASIC programs
- Up to 40 words spoken from one command; speech can occur simultaneously with graphics
- **£37.95** inclusive

Also available: SOUND EXTENSION MODULE for use with the Dragon computer — provides facility to play chords and harmonies — easy to use via BASIC — built-in sound effects — music and graphics can occur together without loss of speed — two I/O ports — User Manual — ONLY **£34.95** inc.

ACCESS/Cheque/P.O. to:

J.C.B. (MICROCYSTEMS)
29 Southbourne Road - Bournemouth - BH6 5AE
Tel: (0202) 423973
Write or phone for further details

Listing 1.

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0 REM FOR £ READ HASH CHARACTER
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2 GOSUB 810
3 GOSUB 880
5 GOSUB 490
6 GOSUB 1000
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Listing 2.

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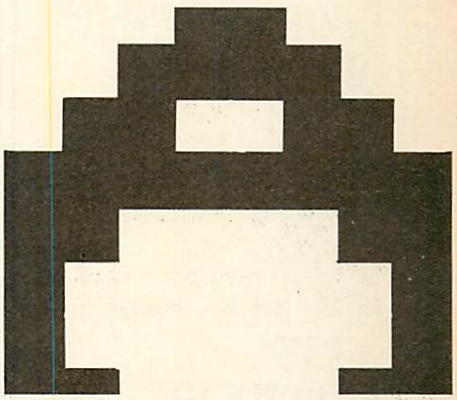
(continued from page 123)

A base is lost if you are hit by an invader's bomb or if an invader reaches the row above your base. The invaders start one row further down after each sheet is completed and they start moving faster the more you shoot.

If you wish to alter the number of bases then change line 810 to:

POKE# GE, X

where X is the number of bases — 1 to 9 — and change the 51 in line 770 to 48 + X. If the characters I have defined are not to your liking then these are contained in lines 10 to 250 — characters 96 to 126. ■



Hex dump.

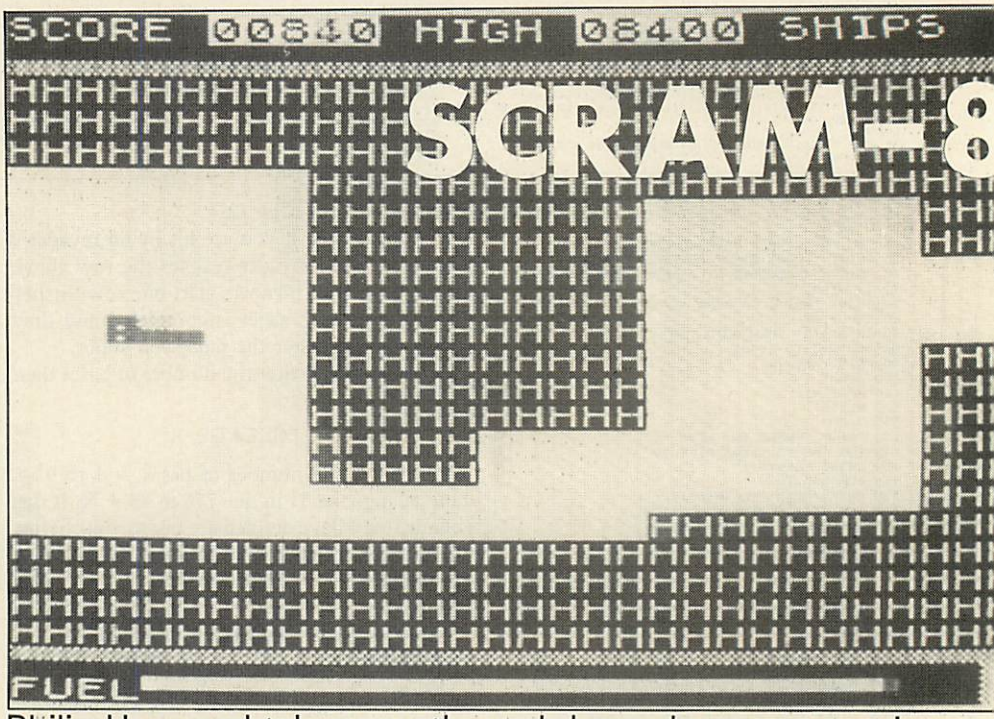
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£1386 - £E9 £28 £85 £73 £A9 £20 £91 £73
£1390 - £73 £88 £91 £73 £A9 £C7 £85 £73
£139A - £91 £73 £C8 £A9 £6E £91 £73 £C8
£13A4 - £91 £73 £E6 £73 £60 £63 £55 £55
£13AE - £55 £55 £A5 £0 £C9 £1 £F0 £E
£13B8 - £D0 £A £A9 £0 £A2 £25 £9D £D2
£13C2 - £D0 £FA £A9 £F6 £85 £82 £A9 £BB
£13CC - £A0 £0 £B1 £82 £C9 £73 £D0 £14
£13D6 - £91 £82 £C6 £82 £88 £B1 £82 £C8
£13E0 - £88 £A9 £20 £91 £82 £18 £90 £8
£13EA - £A5 £82 £C9 £D2 £D0 £DC £AD £F6
£13F4 - £73 £D0 £A £A9 £20 £8D £F6 £BB
£13FE - £BB £C6 £0 £60 £63 £55
```

Test program 1. Background.

```
 100 PRINT AT 1,0;"
(32 X GRAPHIC G)  "
 105 REM ##LEVEL 1##
 110 POKE 20466,130
 120 POKE 20467,64
 130 FOR F=1 TO 255
 140 RAND USR 20733
 150 RAND USR 20764
 160 RAND USR 20815
 170 NEXT F
 180 POKE 20466,12
 190 POKE 20467,83
 200 FOR F=1 TO 32
 210 RAND USR 20733
 220 RAND USR 20764
 230 NEXT F
 235 REM ##LEVEL 2##
 240 POKE 20466,145
 250 POKE 20467,66
 260 POKE 20468,160
 270 POKE 20469,66
 280 POKE 20470,2
 290 FOR F=1 TO 255
 300 RAND USR 20883
 310 RAND USR 20764
 320 RAND USR 20848
 330 RAND USR 20967
 340 NEXT F
 350 POKE 20466,12
 360 POKE 20467,83
 370 FOR F=1 TO 32
 380 RAND USR 20883
 390 RAND USR 20764
 400 NEXT F
 405 REM ##LEVEL 3##
 410 POKE 20466,175
 420 POKE 20467,70
 430 POKE 20471,1
 440 POKE 20472,105
 450 POKE 20473,79
 460 FOR F=1 TO 255
 470 RAND USR 21022
 480 RAND USR 20764
 490 RAND USR 20984
 500 RAND USR 21048
 510 NEXT F
 520 POKE 20466,12
 530 POKE 20467,83
 540 FOR F=1 TO 32
 550 RAND USR 21022
 560 RAND USR 20764
 570 NEXT F
```

Hex loader.

```
100
6998 STOP
6999 REM +++ WRITE +++
7000 CLS
7010 PRINT "READ OR WRITE? (R/W)
"
7020 INPUT M$
7030 PRINT "START ADDRESS"
7040 INPUT S
7050 PRINT "FINISH ADDRESS"
7060 INPUT F
7070 IF M$="R" THEN GOTO 8000
7080 FOR N=S TO F STEP 8
7090 LET T=0
7095 SCROLL
7100 PRINT N;" - ";
7110 INPUT A$
7120 PRINT A$;" = ";
7130 INPUT TOT
7140 PRINT TOT
7145 LET Z=0
7150 FOR K=1 TO LEN A$ STEP 2
7160 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
7170 LET T=T+C
7180 POKE N+Z,C
7190 LET Z=Z+1
7200 NEXT K
7210 IF TOT=T THEN GOTO 7240
7220 SCROLL
7225 PRINT "ERROR - PLEASE INPUT
AGAIN"
7230 GOTO 7080
7240 NEXT N
7250 STOP
7999 REM +++ READ ++++
8000 FOR N=S TO F STEP 8
8005 SCROLL
8010 PRINT N;" - ";
8020 FOR B=0 TO 7
8030 LET C=PEEK (N+B)
8040 LET F$=CHR$ (INT (C/16+28))
8050 LET S$=CHR$ ((C-((CODE F$-2
8)*16))+28)
8055 PRINT F$;S$;
8060 NEXT B
8070 PRINT
8080 NEXT N
```



Philip Harwood takes you through hazardous canyons in the first part of his Scramble-like program for the ZX-81.

THIS PROGRAM, SIMILAR to the arcade game Scramble, reflects all the usual features including the six different levels, on-screen scoring and fuel gauge, bombing and firing, missiles and fuel dumps etc. and consists of about 4K of data and 3K of machine code. It has been split into two major sections: the moving background which includes all the enemy missiles and targets; and the cover screen which superimposes the aircraft and bombs onto the background and deals with the scoring, fuelling and the main controlling.

All the machine code is stored in Rem statements and should be entered in hexadecimal using the hex loader provided. This hex loader will allow machine code to be inputed from the start address which it is given in decimal, starting at 16514. The machine code can also be listed for the correcting of errors.

The first page of this program is concerned only with the background and initial space should be reserved by typing a Rem statement — line 1 — with 521 characters; this can be edited to create lines 2 to 7. Now enter Rem statements 8 to 13 with the lengths indicated in table 1. Check the start and finish addresses for each line number by Poking the end addresses with 128 and listing the lines to make sure that the black squares are at the ends of the lines.

Only when you are sure that all the lines are of the correct length must you enter the hex loader. Lines 50 and 6999 are required because of the Basic programs which help to test the machine code. Lines 1-8 and 13 contain the 4K data for the background terrain. Actual machine code only appears in lines 11 and 12.

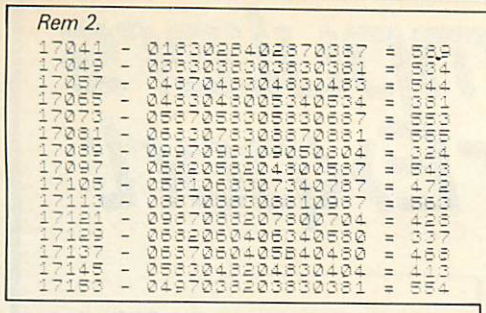
Enter all the data for Rem 1 and Save it onto a cassette. Saving at regular intervals is important, especially before Running machine code. Next enter all the machine-code subroutines into Rem 11 — addresses 20704 to 21073. These routines can be tested by Basic programs. Now enter the data for Rem 10.

Enter lines 100 to 170 of the Basic test program and Run 100. A moving background with missiles which take off, should appear. If the program crashes immediately, check addresses from 20704 to 20845. If a crash appears at a random point — check the data.

Between the first few levels, there is a filler screen which enables a smooth change between the levels. Enter this data into Rem 13 — 21260 to 21324 — and lines 180 to 230

Rem 1.

```
16514 - 02850581068509B3 = 548
16522 - 0A810C870E850F83 = 579
16530 - 0E820E830D850A82 = 575
16538 - 09800AB4098209B4 = 555
16546 - 0880085307830704 = 424
16554 - 0734073406800783 = 390
16562 - 0682068305800684 = 522
16570 - 0580068007850983 = 547
16578 - 0682069707820680 = 568
16586 - 0734073407B40683 = 442
16594 - 0604069706870781 = 444
16602 - 0734068007830781 = 457
16610 - 0681098409870B85 = 614
16618 - 0DB40E8510851104 = 510
16626 - 10040F040D040DB4 = 249
16634 - 0C830A8209040880 = 432
16642 - 0997068009340A34 = 419
16650 - 09800A870AB40A04 = 486
16658 - 0982093409340883 = 400
16666 - 0780059706970783 = 591
16674 - 0704060506B40582 = 343
16682 - 0583043303820383 = 538
16690 - 0583028003340334 = 374
16698 - 0387033004830587 = 544
16706 - 0683078706820580 = 548
16714 - 06B4053006B40580 = 638
16722 - 06B4068707870780 = 604
16730 - 08B4068708830883 = 509
16738 - 0997097097830A81 = 583
16746 - 0BB40B870C870C81 = 625
16754 - 0DB40D870D800E34 = 548
16762 - 0E340E870F870F83 = 511
16770 - 108310820F820F83 = 534
16778 - 0E800F840E800F83 = 625
16786 - 1034103407040984 = 344
16794 - 0981087087810C81 = 566
16802 - 0D970C820B820A82 = 567
16810 - 0A830AB4098209B4 = 559
16818 - 0804083408340704 = 443
16826 - 0604068405800697 = 486
16834 - 0504040404870481 = 389
16842 - 0587068406870734 = 526
16850 - 0734078308870984 = 599
16858 - 09870A870A810A05 = 445
16866 - 09830AB40A870B81 = 615
16874 - 0C870C340C340C04 = 591
16882 - 0C870DB40C830CB4 = 679
16890 - 0B820B970A040AB4 = 507
16898 - 0982088208840782 = 602
16906 - 0704068205820584 = 355
16914 - 0404030403970204 = 178
16922 - 0287028302810334 = 456
16930 - 0387048704830483 = 547
16938 - 0587058306B40687 = 603
16946 - 0583068306B40687 = 601
16954 - 0681078707800687 = 555
16962 - 0880098408800934 = 522
16970 - 0934088009B40880 = 562
16978 - 0997097088009B4 = 645
16986 - 0987093309810A87 = 667
16994 - 0C870D870D820D54 = 601
17002 - 0AB409B4080407B2 = 565
17010 - 0734068206B40582 = 516
17018 - 0404033003340204 = 202
17026 - 0180018001800180 = 516
17034 - FF = 255
```



Rem 2.

```
17041 - 0183025402870387 = 582
17049 - 0383033033830381 = 534
17057 - 0487048304804803 = 544
17065 - 0483048005340534 = 351
17073 - 0587058305870587 = 555
17081 - 0583078305870581 = 555
17089 - 0587095109050504 = 324
17097 - 0685205682043005807 = 540
17105 - 0581068307340787 = 472
17113 - 0887078830581109887 = 555
17121 - 0987078520780070 4 = 555
17129 - 0685205040634056 0 = 337
17137 - 0857060405640480 = 465
17145 - 0583048204830404 = 413
17153 - 0497038203850381 = 554
```

Rem 3.

```
17568 - 0102010301640302 = 145
17576 - 0384040204300502 = 280
17584 - 0584060205030601 = 181
17592 - 0507040704030403 = 37
17600 - 0401030703010380 = 150
17608 - 0207020302010202 = 81
17616 - 0203028402800303 = 275
17624 - 0303030303840380 = 273
17632 - 0403040305020503 = 89
17640 - 0503054068970602 = 310
17648 - 0601050705800503 = 150
17656 - 0501040304010380 = 149
17664 - 0350040303030402 = 150
17672 - 0401033003010302 = 145
17680 - 0303020101800202 = 142
17688 - 0201020202840205 = 148
17696 - 0107013402020284 = 279
17704 - 0207023403840380 = 109
17712 - 0403040104050407 = 32
17720 - 0403038004030380 = 276
17728 - 0402043404800503 = 232
17736 - 0530050705840584 = 420
17744 - 0507083407030780 = 285
17752 - 0707073407070701 = 175
17760 - 0530070105030501 = 153
17768 - 0501043005020501 = 151
17776 - 0403040103030280 = 148
17784 - 0302030102030201 = 17
17792 - 0103013002030180 = 287
17800 - 0203010302020280 = 143
17808 - 0302038004840597 = 423
17816 - 0584050305800584 = 423
```

Rem 4.

```
18095 - 0287028003810382 = 532
18103 - 0381048105810582 = 534
18111 - 0504040503820384 = 205
18119 - 0384038703040384 = 395
18127 - 0357038104870404 = 417
18135 - 0497045704040380 = 433
18143 - 0304033403870381 = 332
18151 - 0483048105830580 = 534
18159 - 0483048105810580 = 534
18167 - 0582058105820480 = 536
18175 - 0583058105820504 = 418
18183 - 0482048304304057 = 454
18191 - 0404030402800283 = 278
18199 - 0132013302840183 = 311
18207 - 0104015702340234 = 249
18215 - 0257020401820181 = 404
18223 - 0158001820197018 1 = 544
18231 - 0287020401800182 = 403
18239 - 0413401540185502 7 = 557
18247 - 0281048505800583 = 537
18255 - 0582050405870583 = 420
18263 - 0504048204810587 = 418
18271 - 0504058704810582 = 418
18279 - 0504048204810587 = 418
18287 - 0581058205040482 = 422
18295 - 0404043404870481 = 336
18303 - 0587058105820581 = 543
18311 - 0582058105810582 = 538
18319 - 0504048204830484 = 422
18327 - 0484048704810587 = 538
18335 - 0582050402050105 = 157
18343 - 0187010401840187 = 455
```

Rem 5.

```
16622 - 0F800F800F800C80 = 569
16630 - 0DB40E800E800E80 = 610
16638 - 0F800F800F800DB4 = 662
16646 - 0C800C800DB40980 = 607
16654 - 0980098DB400DB34 = 569
16662 - 0B340C800D970DB4 = 660
16670 - 0F800F800F800DB4 = 662
16678 - 0C800C800980DB4 = 607
16686 - 0980098009800340 = 396
16694 - 09B400B400797006B4 = 644
16702 - 0700D000D0009B4 = 296
16710 - 0900009B40D000F00 = 2560
16718 - 0DB40D001000DB4 = 4160
16726 - 0B001100DFB40F00 = 2841
16734 - 1200108411200DB4 = 4620
16742 - 1100110011341134 = 4760
16750 - 10B40FB40EB40DB4 = 7760
16758 - 0D0000D340D000EB7 = 2560
16766 - 0C000CB40B400800 = 4000
16774 - 0B340080008B400800 = 3460
16782 - 0B340080008B400800 = 3460
16790 - 0B4E40B400797000B4 = 6460
16798 - 0C340C000DB40D00 = 3200
16806 - 0D000FB97110000FB4 = 3964
16814 - 11000FB411000E00 = 4620
16822 - 11000EB411000DB4 = 4641
16830 - 10000DB412000EB4 = 4641
16838 - 1200113411341134 = 4760
16846 - 1100100797100000 = 3964
16854 - 11001000FB00FB4 = 2360
16862 - 09B400B00000B34 = 1860
16870 - 0B40000000000B4 = 1860
16878 - 0B40B40B40B40B4 = 7560
16886 - 0B0000097000000 = 1900
```

(Rem 5 listing continued on page 129)

Table 1. Data storage for part one — background.

Rem	length	start add	end add	type
1	521	16514	17034	data
2	521	17041	17561	data
3	521	17568	18088	data
4	521	18095	18615	data
5	521	18622	19142	data
6	521	19149	19669	data
7	521	19676	20196	data
8	121	20203	20323	data
9	130	20330	20459	data
10	232	20466	20697	data
11	370	20704	21073	m/c
12	174	21080	21253	m/c
13	65	21260	21324	data

of the test program. Run 100.

This complete, enter the data for Rems — 2 and 3. Enter lines 235 to 400 of the test program. Check addresses 20846 to 20983 and/or the data if a crash occurs.

The data for the height of entry, counting down from the top of the screen, is held in Rem 9 — 20330 to 20459. Enter this data and also the data in Rem 4 for the background.

The distance between the arrows can be increased only: address 20989 holds half the distance between the arrows. Enter lines 405 to 570 of the test program to test this level. If this level works, then all the machine code in Rem 11 is entered correctly and tested by now. Level three uses addresses 20984 to 21073.

As levels 4, 5 and 6 use the same subroutines as before, it is not necessary to have Basic to control/test them. Enter the data in Rems 5 to 8 as before. The Basic must now be converted to machine code which ideally should be called by a single RAND USR statement. This machine code is contained in Rem 12 — the background controller — 21080 to 21253. Enter this code and check it.

Delete the Basic test program, line by line, and insert the following:

```
100 POKE 20476,1
110 POKE 20474,0
120 POKE 20475,0
130 POKE 20476, ((PEEK 20476) - 1)
140 CLS
150 PRINT AT 1,0;"  (32 × graphic G)  "
160 RAND USR 21080
170 IF INKEY$ = "" THEN GOTO 160
180 GOTO 110
```

The complete background should now be available. If a crash appears at a random point, check the relevant data for the background. Pressing any key should start the background at the beginning of the current section. Level six repeats itself until the break key is pressed.

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(Rem 5 listing continued from page 127)

```
18902 - 0D000D3410B410B4 = 470
18910 - 10001000128411B4 = 427
18918 - 10B40F000CB40B00 = 414
18926 - 0B5409000954090B = 398
18934 - 095408000580097 = 354
18942 - 0900090009000900 = 36
18950 - 09000A000A000AB4 = 219
18958 - 0A000B000B40B534 = 277
18966 - 0B340B000E000FB4 = 283
18974 - 11000F5411001100 = 246
18982 - 10541200DB40F00 = 422
18990 - 0C540E000E000DB4 = 413
18998 - 10000FB412001084 = 425
19006 - 12001200FB40E00 = 645
19014 - 0D000D000C000C00 = 90
19022 - 0C000A000A000B00 = 40
19030 - 0700070007000734 = 560
19038 - 0734077707770797 = 1911
19046 - 07B4070008000800 = 2110
19054 - 08B4080008B40800 = 3982
19062 - 0900098408B000A00 = 2119
19070 - 0AB409B409000C00 = 4100
19078 - 0DB40D000FB40EB4 = 5355
19086 - 0DB40DB40EB40FB4 = 7798
19094 - 11000F000F340F34 = 1566
19102 - 0F000E840E000EB4 = 4117
19110 - 0E000E000E340E34 = 1660
19118 - 0F000F000F000EB4 = 2398
19126 - 0E000E970D0000D00 = 2065
19134 - 0D000D0000D0000D00 = 52
19142 - FF = 255
```

Rem 6.

```
19149 - 0D000D000E000E00 = 54
19157 - 0E000E000D000D00 = 55
19165 - 0400040004000400 = 16
19173 - 0400040004000400 = 16
19181 - 0400040004000400 = 16
19189 - 0400040004000400 = 16
19197 - 0400040004000500 = 17
19205 - 0500050005000500 = 20
19213 - 0500050005000B00 = 21
19221 - 0B000B000B000B00 = 44
19229 - 0B000B000B000B00 = 44
19237 - 0C000C000C000C00 = 48
19245 - 0C000B000B000B00 = 44
19253 - 0B000B0002000200 = 44
19261 - 0200020002000200 = 8
19269 - 0200020002000200 = 8
19277 - 0200020002000200 = 8
19285 - 0200020002000200 = 8
19293 - 0200020002000200 = 8
19301 - 0200070007000700 = 28
19309 - 0700070007000400 = 29
19317 - 0400040004000400 = 16
19325 - 0400040004000A00 = 17
19333 - 0A000A000A000A00 = 40
19341 - 0A000A0001000000 = 40
19349 - 1000100010001000 = 64
19357 - 1000100010000A00 = 68
19365 - 0A000A000A000A00 = 40
19373 - 0A000A000A000A00 = 40
19381 - 0A000A000A000A00 = 40
19389 - 0A000A000A000B00 = 41
19397 - 0B000B000B000F00 = 48
19405 - 0F0007000B000500 = 33
19413 - 0400030002000200 = 11
19421 - 0200020002000200 = 8
19429 - 0200020002000200 = 8
19437 - 0200020002000200 = 8
19445 - 0200020002000200 = 8
19453 - 0200020002000200 = 8
19461 - 020002000D000D00 = 30
19469 - 0D000C000B000A00 = 45
19477 - 0900080007000600 = 30
19485 - 0500040004000400 = 17
19493 - 0400040004000400 = 16
19501 - 0400040004000400 = 16
19509 - 0C000C000C000C00 = 48
19517 - 0C000C000C000C00 = 48
19525 - 0C000D000E000E00 = 53
19533 - 0200020002000200 = 8
19541 - 0200020002000200 = 8
19549 - 0200020002000200 = 8
19557 - 0200020002000400 = 10
19565 - 0400030003000300 = 13
19573 - 0300030003000300 = 12
19581 - 0C000C000C000C00 = 48
19589 - 0C000C000C000C00 = 48
19597 - 0C000C000C000C00 = 48
19605 - 0C000F000F000F00 = 57
19613 - 0F000C000C000C00 = 51
19621 - 0C000C000C000C00 = 48
19629 - 0C000C000C000C00 = 48
19637 - 0C000C000C000C00 = 48
19645 - 0C000D000D000D00 = 51
19653 - 0800040002000200 = 16
19661 - 0200020002000200 = 8
19669 - FF = 255
```

Rem 7.

```
19676 - 0300030003000300 = 12
19684 - 0300030003000300 = 12
19692 - 0300030003000300 = 12
19700 - 0300030003000300 = 12
19708 - 03000E000E000E00 = 56
19716 - 0E000E000C000C00 = 56
19724 - 0C000C000C000400 = 49
19732 - 0400040004000400 = 16
19740 - 0400040004000600 = 17
19748 - 0600060006000600 = 24
19756 - 0600060006000600 = 24
19764 - 0700070007000700 = 28
19772 - 0700060006000600 = 25
19780 - 0600060006000600 = 24
19788 - 0600060006000600 = 24
19796 - 0600060006000600 = 24
19804 - 0600100010001000 = 64
19812 - 1000100010001000 = 64
19820 - 0B000B000B000B00 = 44
19828 - 0B000B000B000B00 = 44
19836 - 0B000B000B000700 = 40
19844 - 0700070007000700 = 28
19852 - 0700070007000700 = 28
19860 - 0700070007000200 = 9
19868 - 0200020002000200 = 8
19876 - 0200020002000200 = 8
19884 - 0200020002000200 = 8
19892 - 0200020002000700 = 13
19900 - 0700070007000700 = 28
19908 - 0700040004000400 = 17
19916 - 0400040004000300 = 15
19924 - 0300030003000300 = 12
19932 - 0300030003000300 = 12
19940 - 0300030003000300 = 12
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19964 - 0F000F0003000300 = 36
19972 - 0300030003000300 = 12
19980 - 0300060005000500 = 18
19988 - 0500050005000500 = 20
19996 - 0500050005000500 = 20
20004 - 0500070006000900 = 30
20012 - 0A000B000C000D00 = 46
20020 - 0E000F000F000700 = 51
20028 - 0700070007000700 = 28
20036 - 0700070007000700 = 28
20044 - 0600050004000300 = 18
20052 - 0200020002000200 = 8
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20068 - 0200020002000200 = 8
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20084 - 0200020002000E00 = 29
20092 - 0E00050005000500 = 39
20100 - 0500050005000500 = 20
20108 - 0600060006000700 = 26
20116 - 0700070007000700 = 28
20124 - 0700040004000400 = 17
20132 - 0400040004000400 = 16
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20148 - 0400070007000700 = 28
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20164 - 0700030003000300 = 15
20172 - 0300030003000300 = 12
20180 - 0300030002000200 = 10
20188 - 0200020002000200 = 8
20196 - FF = 255
```

Rem 8.

```
20203 - 0530053005800680 = 533
20211 - 0A8008800480048D = 540
20219 - 0480048012C01237 = 399
20227 - 12341234123312229 = 274
20235 - 0880088008801026 = 482
20243 - 1039103910261028 = 255
20251 - 1030088008800880 = 472
20259 - 0880088008800880 = 544
20267 - 0180018001800180 = 516
20275 - 02D0018001800E80 = 416
20283 - 0E300E300E300330 = 552
20291 - 0330033003300330 = 544
20299 - 0330033003300330 = 536
20307 - 0B300B3003300330 = 540
20315 - 0330065006800680 = 533
20323 - FF = 255
```

Rem 9.

```
20330 - 0102070C040300302 = 34
20338 - 0A020A0E090B0B08 = 72
20346 - 090E0A010C030503 = 57
20354 - 0B0E090D04020B03 = 67
20362 - 0806090A0E0A0504 = 66
20370 - 0A0806090B060B0D = 84
20378 - 0B0507040104B409 = 96
20386 - 0D030B0A030D0A02 = 82
20394 - 0C0E0E010D0D0E0C = 97
20402 - 0A0605040604A0E0C = 97
20410 - 030C0B0C090206A0A = 69
20418 - 07020B0D02020302 = 44
20426 - 0E0A0305A0101A0E = 80
20434 - 0606060E090E0402 = 56
20442 - 0B0B0B0B030E0C0B = 91
20450 - 0404070B0C0E0202 = 56
20458 - 0705 = 15
```

Rem 10.

```
20465 - 8C409E4605025B4F = 525
20474 - FA2001000200001 = 255
20482 - 9714030515035B02 = 390
20490 - B90200BA0200BB02 = 554
20498 - 0015030015030016 = 72
20506 - 0300150300150300 = 53
20514 - 1503001D1D1D1551 = 230
20522 - 3151DB3B5B2B5050 = 764
20530 - 6B5082509B50B150 = 554
20538 - CA50FD5093511E52 = 956
20546 - B4059C07340A971E = 591
20554 - 350A1C0A0D32F24F = 485
20562 - 82F34F4054514FF53 = 1024
20570 - 5123315180FA4FFF = 983
20578 - FB4F20FFF24F91F3 = 1325
20586 - 4F42F44FA0F54F44 = 1020
20594 - F84F0235180315 = 797
20602 - 80FA4FFFFB4F20FF = 1322
20610 - F24FAFF34F45F74F = 1214
20618 - 01F84F6AF94F4FFA = 1091
20626 - 4FFFFB4F20315180 = 954
20634 - FFF24FBEF34F4858 = 1243
20642 - 512C3151955545100 = 589
20650 - FA4FFFFB4F00FFF2 = 1414
20658 - 4FCDF34F4AF44FDC = 1223
20666 - F54F4C03151AD8351 = 915
20674 - ADFF4AFFFFB4F00FF = 1342
20682 - F24FEBF34F4E3151 = 1086
20690 - 9BFA4F3CFB4F00FF = 1125
```

Rem 11.

```
20704 - E5112200A7ED527E = 892
20712 - FE262200D369C1BA7 = 744
20720 - ED527EFE892802236 = 933
20728 - 263E00E1C92A0C40 = 644
20736 - 1143001906E14061F = 180
20744 - 237EFE9CCCE0502B = 1122
20752 - 772310F43600232C3 = 536
20760 - 0D20EBC92A0C40111 = 515
20768 - D502219ED5BF24F1A = 815
20776 - FEFFC847D5112100 = 1043
20784 - 3680A7ED5210F9D1 = 1142
20792 - 131A77FEB42009D5 = 852
20800 - 112100ED52D13625 = 870
20808 - 1321F24F732372C9 = 835
20816 - 2A0C4011FF001911 = 432
20824 - 285006041AD51600 = 391
20832 - 5F19D17EFEB42002 = 923
20840 - 369C1310EFC92A0C = 739
20848 - 4011620019ED5BF4 = 776
20856 - 4F1AFEFFC847D511 = 1115
20864 - 2100368019190FBD1 = 716
20872 - 131A771321F44F73 = 654
20880 - 2372C92A0C401143 = 552
20888 - 00190E14061F237E = 257
20896 - FE362017E5112200 = 543
20904 - A7ED527EFE002006 = 904
20912 - 36363E0018023E1C = 286
20920 - E1181FFE2820043E = 672
20928 - 1C1817FE1C2013E5 = 537
20936 - 1121001857EFE0020 = 487
20944 - 0636283E0018023E = 250
20952 - 36E12B772310BF36 = 737
20960 - 0023230D20B6C921 = 551
20968 - F54F35C036052A0C = 554
20976 - 40116A0119363609 = 522
20984 - 21F74F35C03602ED = 687
20992 - 5BF84F1A472A0C40 = 633
21000 - D5114100191121100 = 370
21008 - 1910FD3613D11321 = 525
21016 - F84F732372C92A0C = 848
21024 - 4011430019OE1406 = 213
21032 - 1F237E2B772310F9 = 654
21040 - 3600232302D20F0C9 = 610
21048 - 2A0C4011430019OE = 241
21056 - 0E061F237E2B7723 = 409
21064 - 10F9360023230D20 = 434
21072 - F0C9 = 441
```

In this month's program you can type in and test the data for six different moving backgrounds with missiles. Next month the routines to play the game itself will be supplied.

(continued from previous page)

term interest of the consumer, I am not saying that strong competition always leads to stagnation. Providing the price cutting stays at a reasonable level, healthy competition ensures that maximum effort — money — is put into developing new hardware to keep ahead of the rest. There is a very fine balance between lethargy and bankruptcy.

One market that most companies seem to approach is education. Government assistance with the cost of purchase of certain types of micro has curtailed the activities of others. Although some standardisation of micros in schools ought to be beneficial, in some instances it could be viewed as a blinkered approach. One of the important aspects of the introduction of computers into the curriculum, is that students should gain experience of hardware actually used in the outside world, not some specially designed machine almost exclusively used in schools.

The education system often seems slow to react to this modern technology — perhaps the past few years have changed this, with an increased emphasis on preparing youngsters for the outside world, and not just teaching the three Rs. Obviously, the government scheme has helped with the hardware, but more interesting is the way that the teachers have taken to the machines.

Any training course for teachers is fully booked, and most disciplines can make use of the training in the classroom. When the first micros became available to schools — from a cost point of view that is — they were used almost exclusively by the mathematics department. In fact, before micros, many secondary schools had a terminal off the local authority main-frame — noisy, slow, unreliable and extremely expensive.

The new micro must have been welcome, often paying for itself in a couple of terms. The traditional home for the school micro, in the maths department, is probably the last place it should be. To confine the school micro to maths students is only confirming the general belief — a glorified calculator.

Special schools, schools for mentally and/or physically handicapped can make excellent use of a computer to effectively decrease the pupil/teacher ratio, leaving more time for the teacher to attend to each child, while others are occupied by the computer. Even relatively simple programs can keep a normally difficult child interested.

The computer is ever patient, never shouts, will not embarrass a child in front of his peers and, most importantly, can record and time every keystroke, giving valuable information to the teacher which otherwise could only be obtained on a one-to-one basis with the child.

If we are concerned about the educators taking to the computers, we need not worry about the kids. I am sure you have noticed how the youngsters seem to accept microcomputers as if they were cars, roller skates or any other everyday item. They know all the latest models and their specifications, the pros and cons of each and which sports the best software.

Perhaps the software is the main focus of their scrutiny. While the adults are still amazed at the latest releases, the younger generation is already familiarising itself with the finer points.

Look into any shop that sells microcomputers and you will doubtless see kids swarming around the display of machines, each actively keying in programs and eagerly awaiting the results. What they program at this stage is quite unimportant. What really matters is that they accept the micro for what it is — a means to an end, not just a means in itself. Later on they will be programming for exactly what *they* want, not what some expert tells them they want.

Is it important that kids should learn "structured" programming right from the start? I do not think so. Nor do I agree with some educationists that Basic should not be allowed in schools. As a language, it does not force any structure, but neither does spoken English. Should we expect our offspring not to speak until they have mastered the basic rules of grammar?

The structure in Basic programming will follow, when the student needs it, just as it does in English. After the initial unorganised attempts at programming, students soon realise how some structure would improve their efforts. Then is the time to introduce Forth, Pascal, Cobol or whatever language is best suited to the job in hand. It is about time the snobbery was taken out of this profession.

The computer age is just dawning for most of us — computers are everywhere and we come into contact with them regularly. ■

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(Rem 5 listing continued from page 127)

```
18902 - 0D000D3410541054 = 470
18910 - 1000100012541154 = 427
18918 - 10540F000CB40B00 = 414
18926 - 0B5409000095409000 = 395
18934 - 0954050005000597 = 364
18942 - 0900090009000900 = 36
18950 - 09000A000A000AE4 = 219
18958 - 0A000B000B540B34 = 275
18966 - 0B340B000E000FB4 = 253
18974 - 11000F5411001100 = 246
18982 - 10541200005540F00 = 422
18990 - 0C540E000E000DB4 = 413
18998 - 10000FB412001084 = 425
19006 - 12001200FB40E000 = 245
19014 - 0D000D000C000C00 = 50
19022 - 0C000A000A000800 = 40
19030 - 0700070007000734 = 80
19038 - 0734073707370737 = 533
19046 - 0734070005000500 = 410
19054 - 0554050005540500 = 392
19062 - 0900095409000A00 = 219
19070 - 0A5409540900C000 = 400
19078 - 0D540D000F540E54 = 595
19086 - 0D540D540E540F54 = 778
19094 - 11000F000F340F34 = 166
19102 - 0F000E540E000E54 = 417
19110 - 0E000E000E340E34 = 150
19118 - 0F000F000F000E54 = 239
19126 - 0E000E970D000D00 = 205
19134 - 0D000D000D000D00 = 52
19142 - FF = 255
```

Rem 6.

```
19149 - 0D000D000E000E00 = 54
19157 - 0E000E000D000D00 = 54
19165 - 0400040004000400 = 16
19173 - 0400040004000400 = 16
19181 - 0400040004000400 = 16
19189 - 0400040004000400 = 16
19197 - 0400040004000500 = 17
19205 - 0500050005000500 = 20
19213 - 0500050005000E00 = 53
19221 - 0B000B000B000B00 = 44
19229 - 0B000B000B000B00 = 44
19237 - 0C000C000C000C00 = 48
19245 - 0C000B000B000B00 = 44
19253 - 0B000B0002000200 = 46
19261 - 0200020002000200 = 8
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19285 - 0200020002000200 = 8
19293 - 0200020002000200 = 8
19301 - 0200070007000700 = 28
19309 - 0700070007000400 = 29
19317 - 0400040004000400 = 16
19325 - 0400040004000A00 = 20
19333 - 0A000A000A000A00 = 40
19341 - 0A000A000A001000 = 45
19349 - 1000100010001000 = 64
19357 - 1000100010000A00 = 56
19365 - 0A000A000A000A00 = 40
19373 - 0A000A000A000A00 = 40
19381 - 0A000A000A000A00 = 40
19389 - 0A000A000A000B00 = 41
19397 - 0B000B000B000F00 = 46
19405 - 0F0007000S000500 = 33
19413 - 0400030002000200 = 11
19421 - 0200020002000200 = 8
19429 - 0200020002000200 = 8
19437 - 0200020002000200 = 8
19445 - 0200020002000200 = 8
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19461 - 020002000D000D00 = 30
19469 - 0D000C000B000A00 = 45
19477 - 0900080007000600 = 30
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19493 - 0400040004000400 = 16
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19509 - 0C000C000C000C00 = 48
19517 - 0C000C000C000C00 = 48
19525 - 0C000D000E000E00 = 53
19533 - 0200020002000200 = 8
19541 - 0200020002000200 = 8
19549 - 0200020002000200 = 8
19557 - 0200020002000400 = 10
19565 - 0400030003000300 = 13
19573 - 0300030003000300 = 12
19581 - 0C000C000C000C00 = 48
19589 - 0C000C000C000C00 = 48
19597 - 0C000C000C000C00 = 48
19605 - 0C000F000F000F00 = 57
19613 - 0F000C000C000C00 = 51
19621 - 0C000C000C000C00 = 48
19629 - 0C000C000C000C00 = 48
19637 - 0C000C000C000C00 = 48
19645 - 0C000D000D000D00 = 51
19653 - 0800040002000200 = 16
19661 - 0200020002000200 = 8
19669 - FF = 255
```

Rem 7.

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19676 - 0300030003000300 = 12
19684 - 0300030003000300 = 12
19692 - 0300030003000300 = 12
19700 - 0300030003000300 = 12
19708 - 0500050005000500 = 20
19716 - 0E000E000E000E00 = 56
19724 - 0C000C000C000400 = 40
19732 - 0400040004000400 = 16
19740 - 0400040004000600 = 17
19748 - 0600060005000600 = 24
19756 - 0600060005000600 = 24
19764 - 0700070007000700 = 28
19772 - 0700060005000500 = 25
19780 - 0500050005000500 = 20
19788 - 0600060005000600 = 24
19796 - 0600060005000600 = 24
19804 - 0600060005000600 = 24
19812 - 1000100010001000 = 64
19820 - 0B000B000B000B00 = 44
19828 - 0B000B000B000B00 = 44
19836 - 0B000B000B000700 = 40
19844 - 0700070007000700 = 28
19852 - 0700070007000700 = 28
19860 - 0700070007000200 = 25
19868 - 0200020002000200 = 8
19876 - 0200020002000200 = 8
19884 - 0200020002000200 = 8
19892 - 0200020002000700 = 28
19900 - 0700070007000700 = 28
19908 - 0700040004000400 = 19
19916 - 0400040004000300 = 13
19924 - 0300030003000300 = 12
19932 - 0300030003000300 = 12
19940 - 0300030003000300 = 12
19948 - 0300030003000F00 = 15
19956 - 0F000F000F000F00 = 60
19964 - 0F000F0003000300 = 16
19972 - 0300030003000300 = 12
19980 - 0300030003000300 = 12
19988 - 0300030005000500 = 18
19996 - 0500050005000500 = 20
20004 - 0500070008000900 = 30
20012 - 0A000B000C000D00 = 46
20020 - 0E000F000F000700 = 51
20028 - 0700070007000700 = 28
20036 - 0700070007000700 = 28
20044 - 0600050004000300 = 19
20052 - 0200020002000200 = 8
20060 - 0200020002000200 = 8
20068 - 0200020002000200 = 8
20076 - 0200020002000200 = 8
20084 - 0200020002000E00 = 30
20092 - 0E000500050005000 = 29
20100 - 0500050005000500 = 20
20108 - 0600060005000700 = 25
20116 - 0700070007000700 = 28
20124 - 0700040004000400 = 19
20132 - 0400040004000400 = 16
20140 - 0400040004000400 = 16
20148 - 0400070007000700 = 25
20156 - 0700070007000700 = 28
20164 - 0700030003000300 = 15
20172 - 0300030003000300 = 12
20180 - 0300030002000200 = 10
20188 - 0200020002000200 = 8
20196 - FF = 255
```

Rem 8.

```
20203 - 0580058005800580 = 533
20211 - 0A800A8004800480 = 540
20219 - 0480048012201237 = 399
20227 - 1234123A12331229 = 274
20235 - 0880088008801026 = 482
20243 - 1039103910261028 = 255
20251 - 1030088008800880 = 472
20259 - 0880088008800880 = 544
20267 - 0180018001800180 = 516
20275 - 020D018001800E80 = 415
20283 - 0E500E500E500550 = 552
20291 - 0550055005500550 = 544
20299 - 0550055005500550 = 536
20307 - 0B500B5003800380 = 540
20315 - 0380058005800580 = 533
20323 - FF = 255
```

Rem 9.

```
20330 - 0102070C04030302 = 34
20338 - 0A020A0E09030503 = 72
20346 - 090E0A010C030503 = 67
20354 - 0B0E090D04020B03 = 67
20362 - 0805090A0E0A0504 = 66
20370 - 0A0505090505050D = 84
20378 - 0805070A010B0409 = 66
20386 - 0D030B0A03000A02 = 66
20394 - 0C0E0E010D0D0E0C = 93
20402 - 0A050504050A0E0C = 80
20410 - 030C0B0C090209 = 44
20418 - 07020B0D0202030B = 66
20426 - 0E0A03050A010105 = 66
20434 - 0805050E090E0402 = 66
20442 - 0805050B0503 = 56
20450 - 0404070B0C0E0202 = 56
20458 - 0705 = 15
```

Rem 10.

```
20466 - 8C409E4605026B4F = 525
20474 - FA2001000200001 = 255
20482 - 971403051503B902 = 390
20490 - B90200BA0200BB02 = 564
20498 - 0016030016030016 = 72
20506 - 0300160300160300 = 53
20514 - 16030001D1D1D1551 = 230
20522 - 3181DB3858B2850050 = 764
20530 - 6550582509550B150 = 554
20538 - DA50FD5093511E52 = 955
20546 - B4059C07340A971E = 591
20554 - 350A1C0A0D32F24F = 485
20562 - 82F34F4054517FF58 = 1004
20570 - 5123315180FA4FFF = 963
20578 - FB4F20FFF24F91F3 = 1326
20586 - 4F42F44FA0F54F44 = 1020
20594 - FB4F0233518031151 = 797
20602 - 80FA4FFFFB4F20FF = 1326
20610 - F24FAFF34F46F74F = 1214
20618 - 01F34F5AF94F4FFA = 1091
20626 - 4FFFFB4F20315180 = 954
20634 - FFF24FBEF34F4858 = 1248
20642 - 512C3151955451005 = 559
20650 - FA4FFFFB4F00FFF2 = 1411
20658 - 4FCDF34F4AF44FDC = 1223
20666 - FB4F4C3151AD8351 = 915
20674 - ADFA4FFFFB4F00FF = 1342
20682 - F24FEBF34F4E3151 = 1065
20690 - 9BFA4F3CFB4F00FF = 1122
20880 - 2372C92A0C401143 = 552
20888 - 00190E14061F237E = 257
20896 - FE362017E5112200 = 643
20904 - A7ED527EFE002006 = 904
20912 - 36363E0018023E1C = 285
20920 - E1181FFE2820043E = 572
20928 - 1C1817FE1C2013E5 = 537
20936 - 1121001197FEE0020 = 487
20944 - 0636283E0016023E = 250
20952 - 36E12B772310BF36 = 737
20960 - 0023230D20B6C921 = 531
20968 - F54F35C036062A0C = 584
20976 - 40116A0119363E5F = 522
20984 - 21F74F35C03602ED = 697
20992 - 5BF84F1A472A0C40 = 633
21000 - D5114100191121100 = 370
21008 - 1910FD3613D11321 = 528
21016 - F84F732372C92A0C = 846
21024 - 401143001906E1406 = 213
21032 - 1F237E2B772310F9 = 654
21040 - 3600232330D20F0C9 = 610
21048 - 2A0C401143001906E = 241
21056 - 0E061F237E2B7723 = 409
21064 - 10F9360023230D20 = 434
21072 - F0C9 = 441
```

Rem 11.

```
20704 - E5112200A7ED527E = 892
20712 - FE26200D369C1BA7 = 741
20720 - ED527EFE89230235 = 932
20728 - 263E00E1C92A0C40 = 544
20736 - 1143001906E14061F = 160
20744 - 237EFE9CCCE05025 = 1122
20752 - 772310F4360023 = 538
20760 - 0D20EBC92A0C4011 = 615
20768 - D50219ED5BF24F1A = 915
20776 - FEFFC847D5112100 = 1043
20784 - 3680A7ED5210F9D1 = 1142
20792 - 131A77FEB42009D5 = 852
20800 - 112100ED52D13525 = 670
20808 - 1321F24F732372C9 = 838
20816 - 2A0C4011FF001911 = 432
20824 - 2850060041AD51600 = 391
20832 - 5F19D17EFEB42002 = 923
20840 - 369C1310EFC92A0C = 739
20848 - 4011620019ED5BF4 = 776
20856 - 4F1AFEFFC847D511 = 1115
20864 - 2100368301910FBD1 = 716
20872 - 131A771321F44F73 = 654
```

In this month's program you can type in and test the data for six different moving backgrounds with missiles. Next month the routines to play the game itself will be supplied.

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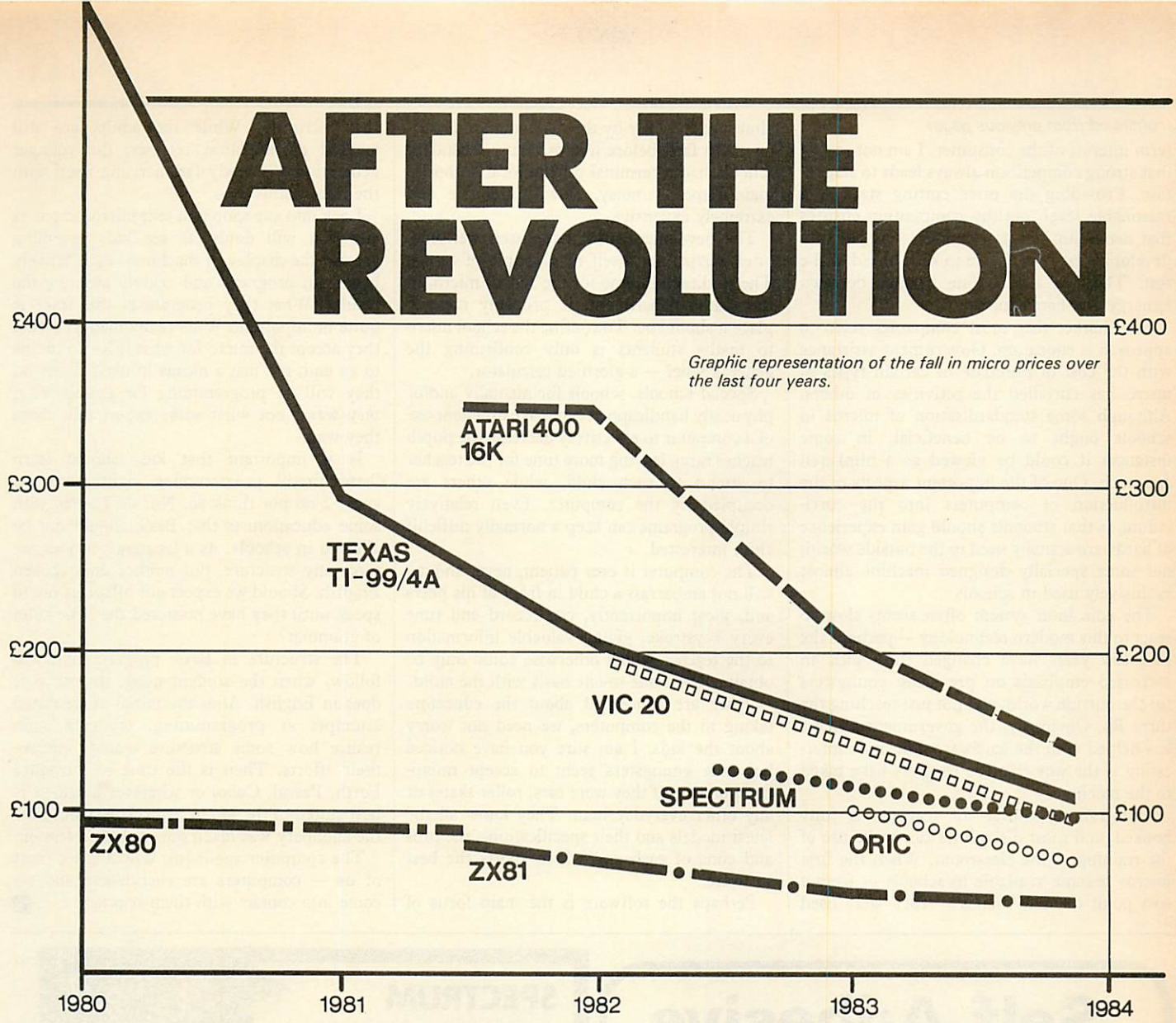
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AFTER THE REVOLUTION



Graphic representation of the fall in micro prices over the last four years.

Martin Soble considers the implications of the computer revolution.

JUST OVER HALF a decade ago the word "computer" meant very little to most people. In those days computer could mean a huge, usually unseen, machine with enormous processing power for repetitive tasks such as printing gas bills or driving licences. A task most modern micros could manage apart from, perhaps, the mass storage requirements. Or computer was the term for the still new electronic calculators; quite correct if my 1981 dictionary is to be believed:

COMPUTER n. electronic machine for making calculations, controlling machinery, etc.

Certainly, six years ago most people had not seen what we now know as a computer, and were only just beginning to read about the new microcomputers.

So why, in an incredibly short time has there been such a revolution? Especially when we consider the variety of uses micros are now being taught. I know that these days technology can move so fast, that what was five years ago an unusual household appliance, the video recorder, is now being accepted along with the washing machine and electric toaster.

The difference is that the computer is interactive. How many toasters can be programmed? How many Hoover user-groups are there?

Without the human interaction, the computer is nothing. I do not care how sophisticated and complex the software or how much thought went into the design, a computer has no imagination.

If the microcomputer encourages individuality, it might be one reason why there are over 300 different microcomputers being produced in the UK alone. Also Britain has the highest rate per capita of personal computers in the world; as many as one in 20 homes according to some surveys.

As the competition hots up, more and more companies join the downward spiral. Lower prices may suit the consumer in the short term, but in the end we will all pay. So long as these machines are being dumped, no return on investment is being realised, especially at the manufacturing end, where huge development programs should be underway to produce the next generation of machines, hopefully cheaper and more powerful than their predecessors.

Recent months have shown the maker of the Newbrain microcomputer, Grundy Business Systems, the way to the receiver's door. It seems unlikely that the machine will continue to be manufactured.

Very recently, Osborne, founder of the first mass-market transportable computer the Osborne 1, also went into liquidation, with debts reported at $23 million — approximately £15 million — equivalent to over $100 for every machine ever sold. Both companies have designed and produced best-selling machines but all too soon the empires come tumbling down, often leaving many thousands of owners without support for their hardware.

Dragon Data has just arranged £2.5 million extra funding to maintain the production of the Dragon 32. This equates to over £20 per Dragon produced so far. The microcomputer business is not a licence to print money. An excellently-designed product is not enough. What so many of these failing companies lack is pure marketing expertise.

The big companies in the home computer business, the ones with existing manufacturing and marketing experience, like Atari, Commodore, Texas Instruments and Tandy, do not want to be pouring more and more money down the development drain. The alternative is to keep producing the existing range, which costs less and less with each production run.

I am told that a Vic-20 costs only $65 — £43 — to make for the USA market. It cannot be a lot more as the retail price is around $90 now, which surely shows how manufacturing costs can be reduced. While this computer can be made at such a low cost, why should the maker waste money developing a new series of machines? Better off adding more RAM and changing the cabinet colour!

While this price war may not be in the long

(continued on next page)

(continued from previous page)
term interest of the consumer, I am not saying that strong competition always leads to stagnation. Providing the price cutting stays at a reasonable level, healthy competition ensures that maximum effort — money — is put into developing new hardware to keep ahead of the rest. There is a very fine balance between lethargy and bankruptcy.

One market that most companies seem to approach is education. Government assistance with the cost of purchase of certain types of micro has curtailed the activities of others. Although some standardisation of micros in schools ought to be beneficial, in some instances it could be viewed as a blinkered approach. One of the important aspects of the introduction of computers into the curriculum, is that students should gain experience of hardware actually used in the outside world, not some specially designed machine almost exclusively used in schools.

The education system often seems slow to react to this modern technology — perhaps the past few years have changed this, with an increased emphasis on preparing youngsters for the outside world, and not just teaching the three Rs. Obviously, the government scheme has helped with the hardware, but more interesting is the way that the teachers have taken to the machines.

Any training course for teachers is fully booked, and most disciplines can make use of the training in the classroom. When the first micros became available to schools — from a cost point of view that is — they were used almost exclusively by the mathematics department. In fact, before micros, many secondary schools had a terminal off the local authority main-frame — noisy, slow, unreliable and extremely expensive.

The new micro must have been welcome, often paying for itself in a couple of terms. The traditional home for the school micro, in the maths department, is probably the last place it should be. To confine the school micro to maths students is only confirming the general belief — a glorified calculator.

Special schools, schools for mentally and/or physically handicapped can make excellent use of a computer to effectively decrease the pupil/teacher ratio, leaving more time for the teacher to attend to each child, while others are occupied by the computer. Even relatively simple programs can keep a normally difficult child interested.

The computer is ever patient, never shouts, will not embarrass a child in front of his peers and, most importantly, can record and time every keystroke, giving valuable information to the teacher which otherwise could only be obtained on a one-to-one basis with the child.

If we are concerned about the educators taking to the computers, we need not worry about the kids. I am sure you have noticed how the youngsters seem to accept microcomputers as if they were cars, roller skates or any other everyday item. They know all the latest models and their specifications, the pros and cons of each and which sports the best software.

Perhaps the software is the main focus of their scrutiny. While the adults are still amazed at the latest releases, the younger generation is already familiarising itself with the finer points.

Look into any shop that sells microcomputers and you will doubtless see kids swarming around the display of machines, each actively keying in programs and eagerly awaiting the results. What they program at this stage is quite unimportant. What really matters is that they accept the micro for what it is — a means to an end, not just a means in itself. Later on they will be programming for exactly what *they* want, not what some expert tells them they want.

Is it important that kids should learn "structured" programming right from the start? I do not think so. Nor do I agree with some educationists that Basic should not be allowed in schools. As a language, it does not force any structure, but neither does spoken English. Should we expect our offspring not to speak until they have mastered the basic rules of grammar?

The structure in Basic programming will follow, when the student needs it, just as it does in English. After the initial unorganised attempts at programming, students soon realise how some structure would improve their efforts. Then is the time to introduce Forth, Pascal, Cobol or whatever language is best suited to the job in hand. It is about time the snobbery was taken out of this profession.

The computer age is just dawning for most of us — computers are everywhere and we come into contact with them regularly. ■

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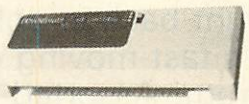
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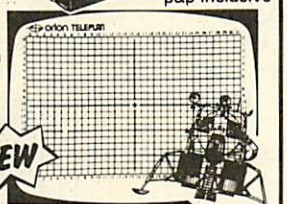
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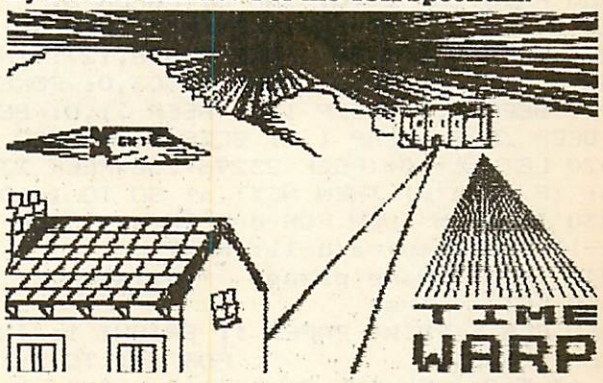
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MAGGOT STOMP

SPEC

The insects fight back in John Charlesworth's fast-moving game for the Spectrum. Assorted molluscs and arachnids are intent on your destruction. And the object? Simply to stay alive.

THIS MACHINE-CODE program entitled Maggots plays the arcade game of centipede on any ZX Spectrum, 16K or 48K. This version has on-screen scoring, machine-code sound, a high-score table and high-speed colour action involving a maggot, a bouncing spider, a very fast snail and your laser base.

The idea in maggots is that you, a little laser base, must survive in a mushroom field while all manner of creepy crawlies try to kill you. You start off with three lives but you lose a life each time you are hit by the spider or a segment of the maggot.

If you bump into the snail it will just go round you. The snail does, however, have a nasty trick — if the snail bumps into a mushroom it will poison it — the mushroom turns from red to green — and later if the maggot hits a poisoned mushroom it will be poisoned and plummet downwards.

To survive you are armed with a laser gun and this is used to shoot up anything that moves and anything which does not. If you shoot a spider or a snail you get 100 points. A segment of the maggot is worth 50 points and where it is shot a mushroom will grow. If you shoot the maggot in the middle it will split up, this will also happen if the spider hits it. For shooting a mushroom you earn 10 points.

When you have finally killed the maggot you will be placed in a new mushroom field with a slightly longer maggot, up to a maximum length of 20 segments. If the maggot ever reaches the bottom of the screen it will keep wandering around in the lower few lines of the screen until either the maggot or you are dead.

For those people interested in machine code the main subroutines and their addresses are given in figure 1 in case you wish to disassemble them.

To enter the program, type in listing 1 and then Save it using

SAVE "MAGGOT"LINE 1

Do not Run it yet as it calls a machine-code routine which has not yet been Poked in and so might crash. Now comes the task of typing in the 2K of machine code.

Type NEW to clear out the computer and then enter listing 2. When Run it should take about two minutes to Poke in the 2K of machine code. As the program Pokes the code in, it will also check it is correct with a checksum. If it is incorrect it will tell you which line is wrong. After the program finally runs correctly, Save the resultant code with

SAVE "CODE"CODE30500,2267

and then verify it with

VERIFY "CODE"CODE

When you now Load the program it will auto-run and Load the machine code, then it will play the game. The instructions are printed on Running the game. Finally if at first you are not very good at the game, address 30613 holds the initial number of lives +1 so if you want n lives type poke 30613,n+1.

Listing 1.

```
  10 INK 7: PAPER 0: BORDER 0: CLEAR 29999: LOAD ""COD
E
  20 CLS : PRINT PAPER 1; BRIGHT 1;"            M A G G
 O T          "
  30 PRINT AT 5,10;"Left  = i";AT 7,10;"Right = p";AT
9,10;"Up    = q";AT 11,10;"Down  = z";AT 13,10;"Fire
= Symbol shift";AT 15,10;"Hold  = h";AT 17,10;"Start =
 s"
  40 DIM a$(5,10): DIM a(5)
  50 PRINT AT 21,0; INK 6; PAPER 3;"     Press any key
 to start     ": IF INKEY$="" THEN GO TO 50
1000 POKE 23675,88: POKE 23676,127: INK 0: LET 1=USR 3
0580: POKE 23300,0: POKE 23303,0: POKE 23306,0
1010 BEEP 1,0: BEEP 1,0: BEEP .1,0: BEEP 1,0: BEEP 1,3
: BEEP .5,2: BEEP 1,2: BEEP 1,0: BEEP .5,-1: BEEP 1,0
1020 LET sc=10*(PEEK 23296+256*PEEK 23297): FOR a=1 TO
 5: IF sc<a(a) THEN NEXT a: GO TO 1060
1030 IF a<>5 THEN FOR b=5 TO a+1 STEP -1: LET a$(b)=a$
(b-1): LET a(b)=a(b-1): NEXT b
1040 INPUT "Name please  ";a$(a)
1050 LET a(a)=sc
1060 CLS : PRINT PAPER 1; BRIGHT 1; INK 7;"          Hi
-Score table          ": FOR a=1 TO 5: IF a(a) THEN PRI
NT AT 5+2*a,5; INK 7;a$(a);"    ";a(a): NEXT a
1070 PAUSE 200: GO TO 1000
```

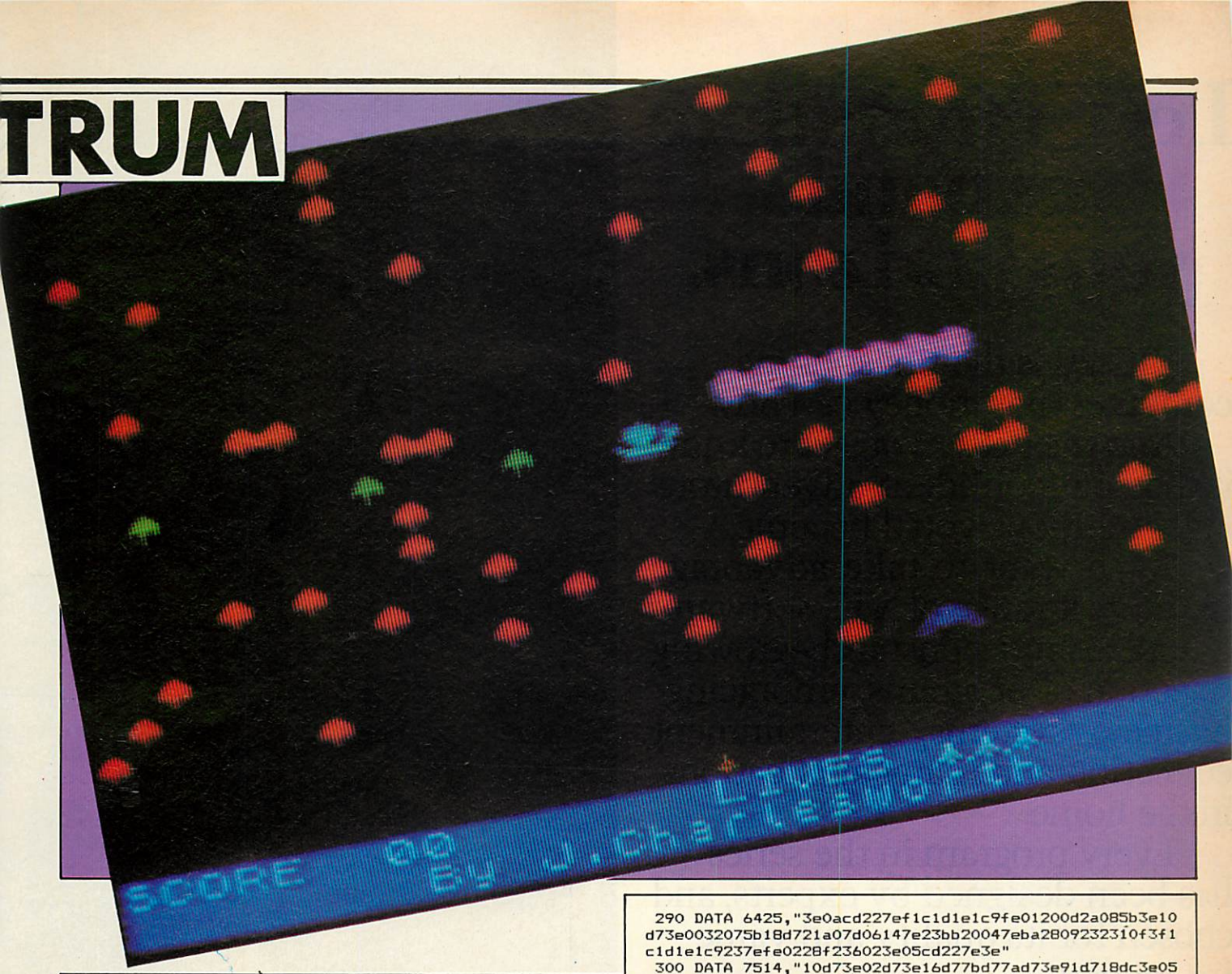
Figure 1.

Read keyboard	= 32515
Move laser base	= 32350
Print score	= 32290
Moye/fire missile	= 31570
Move maggot	= 31240
Move/start snail	= 31080
Move/start spider	= 30890
Print screen	= 30750
Main program	= 30580

Listing 2.

```
  10 CLEAR 30499: LET x=30580: PRINT AT 10,10;"POKING
IN PROGRESS"
  20 FOR l=100 TO 440 STEP 10: READ q,a$: LET t=0
  30 FOR a=1 TO LEN a$ STEP 2
  40 LET b=16*(CODE a$(a)-48-(39 AND a$(a)>"9"))+CODE
a$(a+1)-48-(39 AND a$(a+1)>"9")
  50 POKE x,b: LET t=t+b: LET x=x+1: NEXT a
  60 IF t<>q THEN PRINT "ERROR IN LINE ";l: BEEP 1,30:
 STOP
  70 NEXT l: PRINT AT 10,10;"POKING COMPLETE      ": BE
EP 1,50
 100 DATA 5236,"013c0021dc7d11a07dedb03e1532025b3e1032
035b21000022005b3e08320e5b3e04320d5bcd1e783e00cd227ecd
0c7b3a0d5b47c5cd527bcd5e7ecd087acd68"
 110 DATA 5918,"79cdaa78cd527b3a0d5bc1b8280afe00c83e00
cd5a7d181911050021000 6cdb503110500210004cdb503cdec7cfe
0120bf013c0021dc7d11a07dedb03a0e5b3c"
 120 DATA 4078,"fe142803320e5b3a0d5b3c320d5b18950d5b18
9500000000000000000000000000000000000000000000e5c5d5f5
cd6b0dcdcd1fcd9c7c3e00326b5c3e4f328f"
 130 DATA 5696,"5c214f787efeff2804d72318f797328f5c3e02
326b5cf1d1c1e1c916160053434f5245064c495645530620202020
202020204279204a2e436861726c6573776f"
 140 DATA 2083,"72746820202020202020ff0000000000000000
00000000000000000000000000000000000000000000000000000
```

TRUM




```
0000000000000000e5c5d5f521075b7e235e"
 150 DATA 6498,"23564ffe00203d3a785ce6a8fe002805f1d1c1
e1c9361e2b3a785ce603c612772b36ff000000000000ed5b085b
4ed5cd387ffe06cc0c7b14cd387f15fe06cc"
 160 DATA 7351,"0c7bd1003e10d797d73e16d77bd77ad73e20d7
3e20d7157b815ffe1520020efffe1120020e01d5c5cd387ffe06cc
0c7b14cd387f15fe06cc0c7bc1d17afeff20"
 170 DATA 7699,"0a3e0032075bf1d1c1e1c9ed53085b7932075b
3e10d73e01d73e16d77bd77ad73e97d73e98d7f1d1c1e1c9d1c1e1
c90000000000e5c5d5f53a0a5bfe0020243a"
 180 DATA 7219,"785cfefd2805f1d1c1e1c9210a5b773a795c47
3a785cc6ad10fce60f3c3c2377233600ed5b0b5b3e10d73e00d73e
16d77bd77ad73e20d73e20d71414cd387ffe"
 190 DATA 6892,"002028153e1dba300997320a5bf1d1c1e1c97a
320c5b3e10d73e05d73e16d77bd77ad73e95d73e96d718e2fe0320
06ed5b0b5b18cf3e10d73e04d73e16d77bd7"
 200 DATA 6893,"7ad73e91d71418ebd1c1e1c900000000000000
00f5e5d5c53a0e5b473e01cd217a3cb820f9c1d1e1f1c9000000e5
d5c5f5219d7d110300471910fd22365b5e23"
 210 DATA 6988,"56234e3e02b92005f1c1d1e1c93e10d797d73e
16d77bd77ad73e20d73e03b920041cc3bc7ad57a8157cd387fd100
000000fe00200e7982fe202808feff280457"
 220 DATA 6855,"c3bc7a7a81fe202804feff200879ed444f1cc3
bc7ad5798257cd387fd1fe0420060e031cc3bc7afe062006798257
c3bc7a79ed444f1cc3c57a00000000000000"
 230 DATA 4226,"0000000000000000cd387ffe0420020e033e16
bb20061e11161f0eff3e15bb20073e03b920020e01cd387ffe06cc
0c7b2a365b73237223713e10d73e03d73e16"
 240 DATA 6069,"d77bd77ad73e90d7f1c1d1e1c9000000000000
0000000000e5d5c5f53a0d5b3d320d5b473e01326b5c3e16d73e16
d73e16d73e4f328f5c3e00b828063e94d705"
 250 DATA 7512,"18f53e20d73e02326b5c3e00328f5ccd0f7df1
c1d1e1c900000000000000e5c5d5f5cd667bed5b025bcd037ff1d1
c1e1c900e5d5c5f53a045bfe00201001fe7f"
 260 DATA 6339,"ed78e602fe022005f1c1d1e1c93a045bfe0020
113e0121045b7723ed5b025b7323722b00003e10d73e00d73e16d7
2a055b7dd77cd73e20d72d5d54cd387ffe00"
 270 DATA 6699,"203222055b3e10d73e07d73e16d77dd77cd73e
93d73e00bd20153e10d73e00d73e16d77dd77cd73e20d73e003204
5bf1c1d1e1c9f53e01cd5a7d9732045b2a05"
 280 DATA 7310,"5b2df1fe042804fe0220193e10d797d73e16d7
7dd77cd73e20d73e01cd227ef1c1d1e1c9fe0520222a0b5b3e10d7
97320a5bd73e16d77dd77cd73e20d73e20d7"
 290 DATA 6425,"3e0acd227ef1c1d1e1c9fe01200d2a085b3e10
d73e0032075b18d721a07d06147e23bb20047eba2809232310f3f1
c1d1e1c9237efe0228f236023e05cd227e3e"
 300 DATA 7514,"10d73e02d73e16d77bd77ad73e91d718dc3e05
cd227e3e10d73e02d73e16d77bd77ad73e91d718e1e5d5c5f52a78
5c7de61f577ce60f5f06003e10d73e02d73e"
 310 DATA 7134,"16d77bd77ad73e91d77bc6075f7ac603578357
7b825f3e1fba30067ad6205718f53e12bb30067bd6115f18f510cb
f1c1d1e1c90000000000e5d5c50021a27d3a"
 320 DATA 4537,"0e5b3d477efe02200c23232310f63e0100c1d1
e1c99718f80000002a025b3e10d73e00d73e16d77dd77cd73e20d7
c900000000000000000000000000000000"
 330 DATA 2639,"00000000000000000000000000000000000000
00000000000000000000000C000000000000000e5d5c5f5fe012016
2101000632110100e5c5cdb503c1e1232323"
 340 DATA 5365,"10f018212100000614c50600c57e0607c501fe
00f5e610ed79f117c110f223c110eac110e4f1c1d1e1c900000703
02121c02121c02030502151eff0011020506"
 350 DATA 523,"02151fff070702000a0100090100080100070100
0060100050100040100030100020100010100000100130100120100
0110100100100f01000e01000d01000c01"
 360 DATA 2149,"000b01000a0100090100080100070100060100
0501000401000301000201000101000001000000000000000000e
e5d5c5f53e4f328f5c2a005bf1f516005f19"
 370 DATA 7272,"444d22005b3e01326b5c3e16d73e16d73e07d7
444dcd1b1a3e30d73e02326b5c3e00328f5cf1c1d1e1c9e5c5d5f5
01febfed78e610fe10280b01fefded78e602"
 380 DATA 6894,"fe0228f5ed5b025b01fefbed78e601fe012812
1d7bfe10280ccd387ffe002005cd037f181fed5b025b01fefeed78
e602fe0228101c7bfe16280acd387ffe0020"
 390 DATA 6867,"03cd037fed5b025b01fedfed78e601fe012812
147afe20280ccd387ffe002005cd037f181fed5b025b01fedfed78
e604fe042810157afeff280acd387ffe0020"
 400 DATA 7740,"03cd037ff1d1c1e1c9000000000000e5d5c5f5
3e16d72a025b7dd77cd73e10d73e00d73e20d7ed53025b3e10d73e
06d73e16d77bd77ad73e94d7f1c1d1e1c900"
 410 DATA 6190,"00000000e5d5c597210058bb2809d543112000
1910fdd15a1600197ec1d1e1c9000000003c7effffffff7e3c183c
7effffdb5a18003c5a7e182466a500181818"
 420 DATA 4465,"1818180000000018183c7e99030f1f1f0f677f
1f00cceaefce9cfcf80001070d1f3350500080e0b0f8cc0a0a0002
020242423c000044487048444200000404040"
 430 DATA 3578,"40407e000042665a4242420000426252 4a4642
00003c424242423c00007c42427c404000003c4242524a3c00007c
42427c444200003c403c02423c0000fe1010"
 440 DATA 438,"10101000004242424242 3c0000000000000000
0000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000"
```

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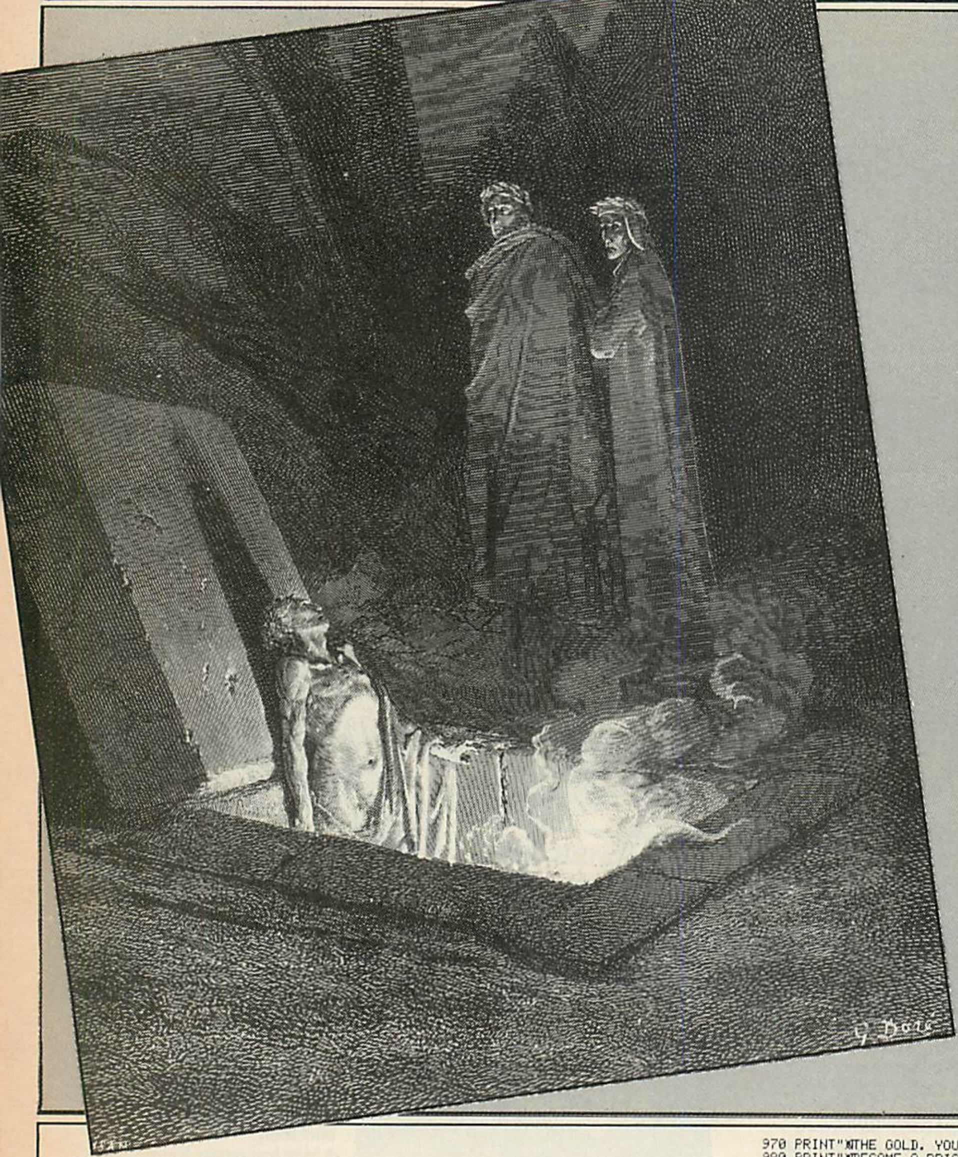
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(continued from page 140)

seconds to draw maze 3. The maze is stored in the unused 4K block of memory beginning at $C000 hex — 49152 decimal.

The maze is presented to you on a 5 by 5 grid, with the centre square being where you are currently standing in the maze. You are represented in the middle of the screen by a multi-colour mode sprite. This sprite changes depending on whether you are carrying the sword, the gold or nothing.

To move around the maze, you can use a joystick in central part 2, or the keys:

T — Up
F — Left
H — Right
V — Down

When you move around the maze, you do not actually move around but, but the maze moves around you.

The number of monsters and swords in each maze depends on the size of the maze.

Maze 1 — 15 monsters : 15-19 swords
Maze 2 — 20 monsters : 20-24 swords
Maze 3 — 25 monsters : 25-29 swords

When typing in the masses of Data statements, I suggest that you Save them on'to tape first before Running it because any mistakes in the Data statements might cause the machine to crash.

To make sure that the Data has been typed in correctly, or to be 99 per cent sure, you can Run 20000.

This will add up all the Data and check the total with what it should be. If the total is not equal to it, then you are told that there is an error in Data, otherwise you are told that the Data is OK. This check might not work if you have made more than one mistake in the Data as the totals of the numbers may be the same as they would be if the Data was correct.

(listing continued from page 140)

```
297 FORG=1TO23:PRINTTAB(25)"                    ■":NEXT
298 PRINTTAB(25)"                  "
299 FORG=2009TO2023:POKEG,160:POKEG+54272,14:NEXT:POKEO+21,1
300 POKE823,INT(Q/256):POKE822,Q-PEEK(823)*256:SYS38057:MO=MO-1:IFMO<=0THEN800
301 POKE4,INT(RND(1)*4):SYS40800:SYS38057:IFPEEK(Q)=100THEN900
302 C=0:VV=PEEK(56320):V=PEEK(197):GETH$:IFH$="■"THEN350:REM TYPE F1
305 IFV=22ORVV=126THENC=-IN:GOTO310
306 IFV=21ORVV=123THENC=-1:GOTO310
307 IFV=31ORVV=125THENC=IN:GOTO310
308 IFV=29ORVV=119THENC=1:GOTO310
309 GOTO301
310 W=PEEK(Q+C):IFW=25THEN301
311 IFW=0THENQ=Q+C:GOTO300
312 IFW=150THENTR=1:POKEQ+C,(25ANDSW=0)OR(50ANDSW=1):SW=0:GOTO410
313 IFW=50ANDSW=0THENSW=1:POKEQ+C,(25ANDTR=0)OR(150ANDTR=1):TR=0:NS=NS-1:GOTO400
314 IFW=75THEN1000
315 IFW=100THENQ=Q+C:POKE823,INT(Q/256):POKE822,Q-PEEK(823)*256:SYS38057:GOTO900
316 IFW=175ANDTR=1THEN500
317 GOTO301
350 POKE198,0:POKE53280,0
360 GETR$:IFR$<>"■"THEN360:REM TYPE F1
370 POKE198,0:POKE53280,14:GOTO301
400 POKE2040,14:POKEO+38,8:GOTO301
410 POKE2040,15:POKEO+38,8:GOTO301
500 FORG=1TO500:NEXT
510 POKE53280,0:POKE53281,0:POKEO+21,0
520 PRINT"WELL DONE!!! YOU HAVE SUCCEEDED IN YOUR QUEST FOR THE GOLD."
525 RT=INT(MO/(MA-HI*4)*100+0.5):POKE198,0
530 PRINT"YOUR RATING IS";RT
540 IFRT>H(5)THEN550
545 GOTO982
550 INPUT"YOUR NAME";IN$
555 IFIN$=""ORLEN(IN$)>10THENPRINT"":GOTO550
560 H(5)=RT:H$(5)=IN$
562 FORI=1TO4
564 IFH(I)>=H(I+1)THEN570
565 P=H(I):H(I)=H(I+1):H(I+1)=P:P$=H$(I):H$(I)=H$(I+1):H$(I+1)=P$:Y=1
570 NEXT
575 IFY=1THENY=0:GOTO562
580 GOTO982
800 POKEO+21,0:FORH=1TO15:PRINT""TAB(26)"NO MORE MOVES"
810 FORG=1TO100:NEXT
820 PRINT""TAB(26)""
830 FORG=1TO100:NEXTG,H
840 GOTO960
900 POKEO+21,0:FORJ=1TO500:NEXT
905 IFSW=1THENPOKEQ,0:SW=0:MO=MO+UG:NM=NM-1:POKEO+38,0:POKEO+21,1:GOTO300
906 IFRND(1)>0.75THENPOKEQ,0:NM=NM-1:MO=MO-UG:POKEO+21,1:GOTO300
910 E$=""
920 FORG=1TO10:PRINTE$"DEATH■"
930 FORH=1TO100:NEXT
940 PRINTE$"     "
950 FORH=1TO100:NEXTH,G
960 POKE53280,0:PRINT"YOU HAVE FAILED IN YOUR ATTEMPT TO GET"
970 PRINT"THE GOLD. YOU GET A RATING OF ZERO AND"
980 PRINT"BECOME A PRISONER IN THE MAZES OF HELL."
982 PRINT""TAB(10)"CURRENT TOP RATINGS":PRINTTAB(10)"======= === ======="
984 FORI=1TO5:PRINTTAB(7);""I;TAB(14);""H$(I);TAB(28);""H(I):NEXT
999 FORG=1TO1000:M(G)=0:NEXT:GOTO41
1000 POKEO+21,0:I$="MOVES LEFT":MO=MO-UG:PR=PR-1:GOSUB268
1005 PRINT"THIS REPORT COSTS YOU"UG"MOVES"
1010 PRINT"HIT A KEY TO RETURN TO GAME■"
1020 POKE198,0:WAIT198,1:POKE198,0
1030 POKEQ+C,25:GOTO296
10000 DATA169,192,133,252,169,0,133,251,169,25,145,251,24,165,251,105,1,133
10001 DATA251,165,252,105,0,133,252,201,208,208,235,96
10002 DATA169,0,133,4,160,0,189,124,146,145,253,189,136,144,145
10003 DATA251,232,200,192,5,208,240,24,165,253,105,40,133,253,165
10004 DATA254,105,0,133,254,24,165,251,105,40,133,251,165,252,105
10005 DATA0,133,252,230,4,165,4,201,5,208,204,96,162,0,160
10006 DATA0,142,52,3,24,173,54,3,125,62,3,133,251,173,55
10007 DATA3,105,0,133,252,177,251,141,53,3,189,208,157,133,253
10008 DATA189,52,158,133,254,189,152,158,133,251,189,252,158,133,252
10009 DATA174,53,3,32,112,148,174,52,3,160,0,56,173,54,3,253,62
10010 DATA3,133,251,173,55,3,233,0,133,252,177,251,141,53,3
10011 DATA189,64,156,133,253,189,164,156,133,254,189,8,157,133,251
10012 DATA189,108,157,133,252,174,53,3,32,112,148,174,52,3,232
10013 DATA224,12,208,144,96
10014 DATA160,2,160,2,160,2,160,2,160,2,160,2,170,1,170,1,170,1,160,2,160,2
10015 DATA170,1,170,6,170,1,160,2,160,2,170,1,170,1,170,1,160,2,160,2,160,2,160
10016 DATA2,160,2,160,2
10017 DATA205,8,160,8,160,7,160,8,206,8,160,8,170,3,170,3,170,3,160,8,160,7
10018 DATA170,3,214,3,170,3,160,7,160,8,170,3,170,3,170,3,160,8,206,8,160,8,160
10019 DATA7,160,8,205,8
10020 DATA112,13,64,13,64,13,64,13,110,13,93,13,160,10,160,10,160,10,93,133
10021 DATA93,13,160,10,160,10,160,10,93,13,93,13,160,10,160,10,160,10,93,13
10022 DATA109,13,64,13,64,13,64,13,125,13
10023 DATA236,1,160,4,102,6,160,4,251,1,160,4,105,4,32,0,95,4,160,4,102,6,64,3
10024 DATA64,3,91,3,102,6,160,4,223,4,32,0,233,4,160,4,252,1,160,4,102,6,160,4
10025 DATA254,1
10026 DATA102,1,160,2,170,1,160,2,102,1,160,2,236,3,160,3,251,3,160,2,170,1,160
10027 DATA3,209,3,160,3,170,1,160,2,202,3,192,3,203,3,160,2,102,1,160,2,170,1
10028 DATA160,2,102,1
10029 DATA127,2,104,4,104,4,104,4,255,2,85,6,209,7,160,7,209,7,73,6,74,6,160,7
10030 DATA215,7,160,7,75,6,32,0,95,7,192,7,105,7,32,0,255,2,32,0,32,0,32,0,127,2
10031 DATA160,0,162,0,189,180,145,133,253,189,181,145,133,254,177
10032 DATA253,201,100,240,19,230,4,165,4,201,4,208,4,169,0
10033 DATA133,4,232,232,224,50,208,222,96,169,0,145,253,164,4
10034 DATA185,120,145,141,130,145,160,0,165,4,201,0,240,45,201
10035 DATA1,240,4,201,2,240,37,56,165,253,237,130,145,133,253
10036 DATA165,254,233,0,133,254,177,253,201,0,208,17,169,100,145
10037 DATA253,165,253,157,180,145,165,254,157,181,145,24,144,172,24
10038 DATA165,253,109,130,145,133,253,165,254,105,0,133,254,177,253
10039 DATA201,0,208,199,201,0,240,215
10040 DATA0,16,0,48,84,0,49,169,0,49,169,0,48,168,0,48,168,0,252,32,0,50,86,0,50
10041 DATA70,0,2,86,0,10,70,0,0,86,0,0,69,0,0,84,0,0,136,0,0,136,0,0,136,0,0,136
10042 DATA0,0,136,0,2,138,0,0,0,0
10043 DATA0,16,0,0,84,0,1,169,0,1,169,0,0,168,0,0,168,0,0,32,0,2,86,0,11,71,128
10044 DATA47,87,224,47,71,224,11,87,128,2,70,0,0,84,0,0,136,0,0,136,0,0,136,0,0
10045 DATA136,0,0,136,0,2,138,0,0,0,0
20000 FORG=1TO756:READA:C=C+A:NEXT:RESTORE
20001 IFC<>74851THENPRINT"ERROR IN DATA":END
20002 PRINT"DATA O.K."
```



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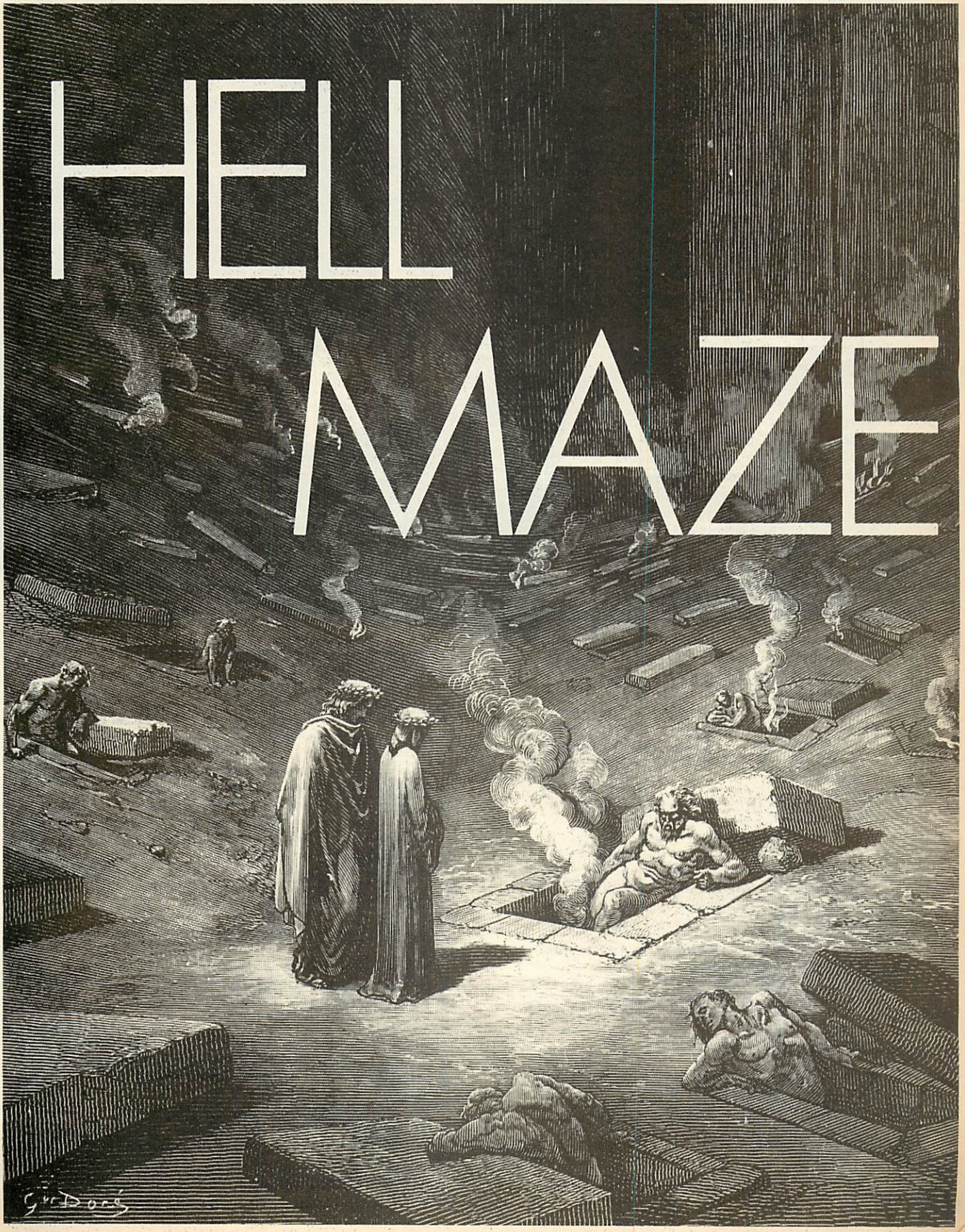
Fight your way out of hell in Martin Lightfoot's infernally evil maze game for Commodore's CBM-64.

HELL IS A MAZE adventure game for the Commodore 64. It consists of a mainly Basic program with two main machine-code subroutines, one for moving the monsters around the maze and another to print the maze on the screen.

The object of the game is to find the gold and then return to base with it in your arms.

To make life difficult there are monsters moving around the maze which must be avoided or killed using one of the swords in the walls of the maze. If you attempt to kill a monster without a sword in your hand you

(continued on next page)



(continued from previous page)

still have a chance of survival as long as the random number produced is greater than 0.75. If you do kill a monster without a sword, you lose some of your moves, but killing one with a sword will gain you some moves.

Also in the mazes of Hell are little smiling faces called prisoners. Running into one of these will provide you with a maze report update but, in return, they will pinch some of your moves.

Play can be halted during the middle of a game in case of an emergency by pressing F1. The screen goes black indicating the game has stopped. To restart the game, press F1 again. The screen colours should then return to normal.

If you are successful in your quest for the gold you will be given a rating with one hundred plus being an excellent score.

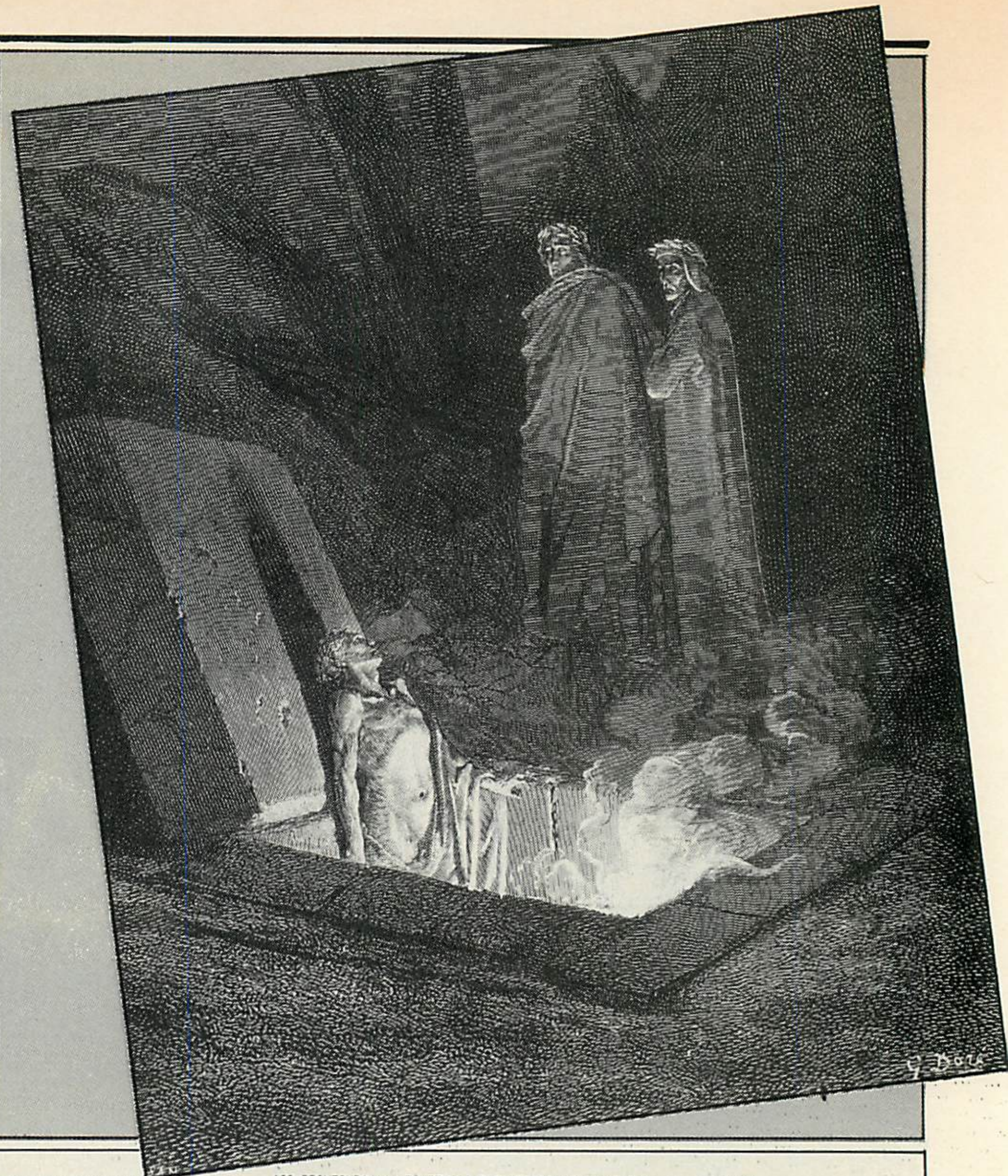
If your rating is in the top five scores so far, then you are asked to input your name for the high score table. The maximum length of name that the program will accept is 10 characters.

If you fail in your attempt for the gold, you get a rating of zero and become a prisoner in the mazes of Hell. You are only allowed to carry one thing at any one time. Everytime the program is Run, a new maze is drawn making each game entirely different.

There are three sizes of maze to choose from. You select the one you want at the beginning of the game. You are asked to press a key from one to three with one being the smallest maze — approximately the same size as the screen — and three the largest — four times as big as the screen.

It takes in the region of 40 seconds to draw maze 1, 80 seconds to draw maze 2 and 135

(continued on page 142)



```
0 POKE51,0 POKE52,144 POKE55,0 POKE56,144 CLR PRINTCHR$(8) DIMCO(23),CA(23),M(1
000)
1 FORL=0TO4 CA(L)=1024+5*L CO(L)=55296+5*L CA(L+5)=1224+5*L CO(L+5)=55496+5*L N
EXT
2 CA(10)=1424 CA(11)=1429 CA(12)=1439 CA(13)=1444 CO(10)=55696 CO(11)=55701
3 CO(12)=55711 CO(13)=55716 FORG=1TO5 H(G)=0 H$(G)="----------" NEXT GOTO41
4 FORL=0TO4 CA(L+14)=1624+L*5 CO(L+14)=55896+L*5 CA(L+19)=1824+L*5
5 CO(L+19)=56096+L*5 NEXT Z=40700
6 FORL=0TO11 POKE40100+L,INT(CA(11-L)/256) POKE40000+L,CA(11-L)-PEEK(40100+L)*2
56 NEXT
7 FORL=0TO11 POKE40300+L,INT(CO(11-L)/256) POKE40200+L,CO(11-L)-PEEK(40300+L)*2
56 NEXT
8 FORL=0TO11 POKE40500+L,INT(CA(L+12)/256) POKE40400+L,CA(L+12)-PEEK(40500+L)*2
56 NEXT
9 FORL=0TO11 POKEZ+L,INT(CO(L+12)/256) POKE40600+L,CO(L+12)-PEEK(Z+L)*256 NEXT
GOTO28
10 IFPEEK(P+X)=ZTHEND(T)=X/2 T=T+1
11 RETURN
20 Z=25 P=49152+10*X+20 O=P M=0 E=X*2 HI=0
21 POKEP,0 T=0 X=-E GOSUB10 X=-2 GOSUB10 X=E GOSUB10 X=2 GOSUB10
22 IFM>HITHENHI=M
23 IFT>0THEND=D(T*RND(1)) M(M)=P M=M-(T>1) POKEP+D,0 P=P+2*D GOTO21
24 M=M-1 IFM=-1THEN100
25 P=M(M) IFPEEK(P-E)<>ZANDPEEK(P+E)<>ZANDPEEK(P+2)<>ZANDPEEK(P-2)<>ZTHEN24
26 GOTO21
28 FORG=36865TO36894 READA POKEG,A NEXT FORG=38000TO38171 READA POKEG,A NEXT
29 FORG=37500TO37524 POKEG,32 POKEG-500,0 NEXT
30 FORG=37525TO37549 READA,B POKEG,A POKEG-500,B NEXT
31 FORG=37625TO37649 POKEG,102 POKEG-500,6 NEXTG
32 FORG=37650TO37674 READA,B POKEG,A POKEG-500,B NEXT
33 FORG=37675TO37699 READA,B POKEG,A POKEG-500,B NEXT
34 FORG=37550TO37574 READA,B POKEG,A POKEG-500,B NEXT
35 FORG=37575TO37599 READA,B POKEG,A POKEG-500,B NEXT
36 FORG=37600TO37624 READA,B POKEG,A POKEG-500,B NEXT FORG=40800TO40927 READA
37 POKEG,A NEXT FORG=896TO958 READA POKEG,A NEXT
38 FORG=960TO1022 READA POKEG,A NEXT GOTO70
41 SW=0 TR=0 POKE53280,3 POKE53281,3 PRINT"[graphics]
"
42 PRINT"[graphics] "
43 PRINT"[graphics] "
44 PRINT"[graphics] "
45 PRINT"[graphics] "
50 PRINT"[graphics]"
55 PRINT"[cursor]"TAB(8)"CAN YOU SURVIVE IN....."
60 PRINT"[cursor]            A MAZE ADVENTURE GAME"
62 PRINT"[cursor]"TAB(18)"BY"
65 PRINT"[cursor]"TAB(11)"MARTIN LIGHTFOOT" IFPEEK(1018)<>138THEN4
70 POKE198,0 PRINT"[cursor]"TAB(14)"HIT A KEY "
80 GETR$ IFR$=""THENX=RND(0) GOTO80
81 PRINT"[clr]"TAB(9)"INPUT MAZE SIZE(1-3) ";
82 GETR$ IFR$<"1"ORR$>"3"THEN82
83 PRINTR$ IFR$="1"THENX=41 Y=30 PT=5 NM=15 NS=15+INT(RND(1)*5)
84 IFR$="2"THENX=61 Y=40 PT=8 NM=20 NS=20+INT(RND(1)*5)
85 IFR$="3"THENX=79 Y=50 PT=11 NM=25 NS=25+INT(RND(1)*5)
86 IN=X SYS36865 FORG=0TOX-1 POKE49152+G,125 POKE49152+X*Y+G,125 NEXT
87 FORG=0TOX*YSTEPX POKE49152+G,125 POKE49151+X+G,125 NEXT
88 POKE830,1 POKE831,2 POKE832,X-2 POKE833,X-1 POKE834,X POKE835,X+1 POKE836,X+
2
89 POKE837,X*2-2 POKE838,X*2-1 POKE839,X*2 POKE840,X*2+1 POKE841,X*2+2
90 PRINT"[clr]"TAB(9)"     DRAWING MAZE     "
95 PRINTTAB(13)"PLEASE WAIT."
96 POKE53281,14 POKE53280,14
98 GOTO20
100 IFM(HI)<>0THENPOKEM(HI),150 GOTO105
101 POKEM(HI-1),150
105 PRINT"[clr]"TAB(13)"MAZE READY  "
110 PRINTTAB(13)"PRESS A KEY "
120 POKE198,0 WAIT198,1 POKE198,0
130 PRINTCHR$(14) POKE53280,0 POKE53281,0 PRINT"[graphics]"
140 PRINT"[cursor]USE KEYS:-   [graphics]"
150 PRINT"[cursor]"TAB(18)"OR USE A JOYSTICK"
155 PRINTTAB(18)"TO GUIDE YOUR MAN" PRINTTAB(18)"AROUND THE MAZES OF"
160 PRINT"[cursor]"TAB(18)"[graphics]."
161 PRINT"[cursor]FIND THE GOLD AND THEN TRY TO ESCAPE    FROM THE MAZE AVOIDING THE
";
162 PRINT" MONSTERS"
163 PRINT"WHICH ARE OUT TO GET YOU."
164 PRINT"[cursor]RUN INTO A PRISONER FOR A [graphics]   UPDATE BUT BE PREPARED TO
";
165 PRINT" LOOSE SOME OF YOUR MOVES."
166 PRINTTAB(10)"[graphics]" POKE198,0
167 GETR$ IFR$=""THEN167
170 L=0 PRINT"[clr]"CHR$(142)
175 AA=1024 CC=55296 M1=50 GOSUB220 PRINT"[cursor]"TAB(7)"- SWORD"
176 IFL=1THEN240
180 AA=1264 CC=55536 M1=75 GOSUB220 PRINT"[cursor]"TAB(7)"- PRISONER"
181 IFL=1THEN240
185 AA=1504 CC=55776 M1=100 GOSUB220 PRINT"[cursor]"TAB(7)"- MONSTER"
186 IFL=1THEN240
190 AA=1744 CC=56016 M1=150 GOSUB220 PRINT"[cursor]"TAB(7)"- GOLD"
191 IFL=1THEN240
195 AA=1044 CC=55316 M1=175 GOSUB220 PRINT"[cursor]"TAB(27)"- BASE"
196 IFL=1THEN240
200 PRINT"[cursor]"TAB(20)"HIT A KEY FOR MAZE"
205 PRINTTAB(26)"REPORT"
210 POKE198,0 WAIT198,1 POKE198,0 GOTO240
220 FORG=0TO4 FORH=0TO4 POKEAA+H+G*40,PEEK(37500+M1+H+G*5)
221 GETR$ IFR$<>""THENH=4 G=4 L=1
222 POKECC+H+G*40,PEEK(37000+M1+H+G*5) NEXTH,G RETURN
240 PRINT"[clr]"
245 PR=INT(RND(1)*PT)+2
246 FORG=1TOPR
247 AD=INT(RND(1)*(IN*Y))+49152 IFPEEK(AD)=25THENPOKEAD,75 GOTO249
248 GOTO247
249 NEXT
250 FORG=0TO((NM*2)-2)STEP2
251 D=INT(RND(1)*(IN*Y))+49152 IFPEEK(D)=0THEN253
252 GOTO251
253 POKE37301+G,INT(D/256) POKE37300+G,D-256*PEEK(37301+G) POKED,100 NEXT
254 POKE37240,1 POKE37241,1 POKE37242,IN POKE37243,IN
255 POKE40835,NM*2 FORG=1TO(NS-1)
256 D=INT(RND(1)*(IN*Y))+49152
257 IFPEEK(D)=25THENPOKED,50 GOTO259
258 GOTO256
259 NEXT
260 O=53248 POKE2040,14 POKEO+28,1 POKEO+38,0 POKEO+37,11 POKEO+39,15 POKEO+29,
1
261 POKEO+23,1 POKEO,105 POKEO+1,130 POKEO+37,11 POKEO+38,0 POKEO+39,12
267 MO=HI*6 MA=MO UG=INT(RND(1)*20)+10 I$="MOVES IN TOTAL" GOSUB268 GOTO290
268 POKE53280,11 POKE53281,11 PRINT"[clr]"TAB(13)"MAZE REPORT"
269 PRINT"[cursor]YOU HAVE",MO,I$
270 PRINT"[cursor]THERE ARE "NM"MONSTERS"
275 PRINTTAB(15)NS"SWORDS" PRINTTAB(15)PR"PRISONERS"
276 IFSW=1THENPRINT"[cursor]YOU ARE HOLDING A SWORD"
277 IFTR=1THENPRINT"[cursor]YOU ARE CARRYING THE GOLD"
280 PRINT"[cursor]MAZE SIZE = " IN"X"Y
285 PRINT"[cursor]YOU GAIN",UG,"MOVES FOR A KILL" RETURN
290 PRINT"[cursor]GOOD LUCK!!!" PRINT"[cursor]"TAB(8)"HIT A KEY FOR GAME START" PO
KE198,0
291 GETR$ IFR$=""THEN291
292 POKEO,175 IFPEEK(O-1)=25THENPOKEO-1,50 GOTO296
293 IFPEEK(O+1)=25THENPOKEO+1,50 GOTO296
294 IFPEEK(O-IN)=25THENPOKEO-IN,50 GOTO296
295 IFPEEK(O+IN)=25THENPOKEO+IN,50
296 PRINT"[clr]" POKE53281,0 POKE53280,14
```

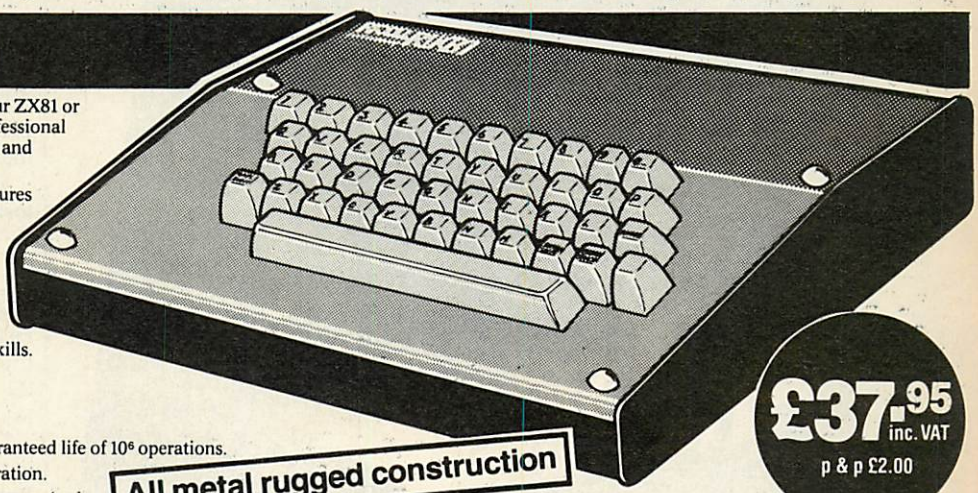
(listing continued on page 142)

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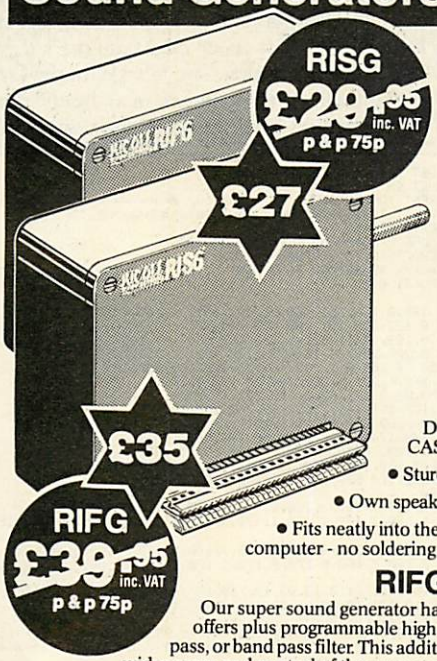
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- Simple connection, no soldering, no special skills. All you need is a screwdriver and pliers.
- Complete with full instructions.
- Double shift key.
- Switches have gold-plated contacts and a guaranteed life of 10^6 operations.
- Ergonomically shaped front ensures easy operation.

Be sure to state whether ZX81 or Spectrum type required.

All metal rugged construction

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Additional feature: the provision of two 8 bit input/output ports.

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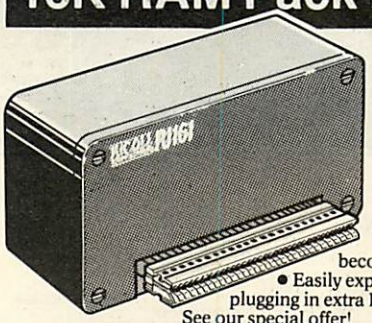
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- Sturdy plastic case.
- Fits neatly into rear of computer.

'state of the art' technology

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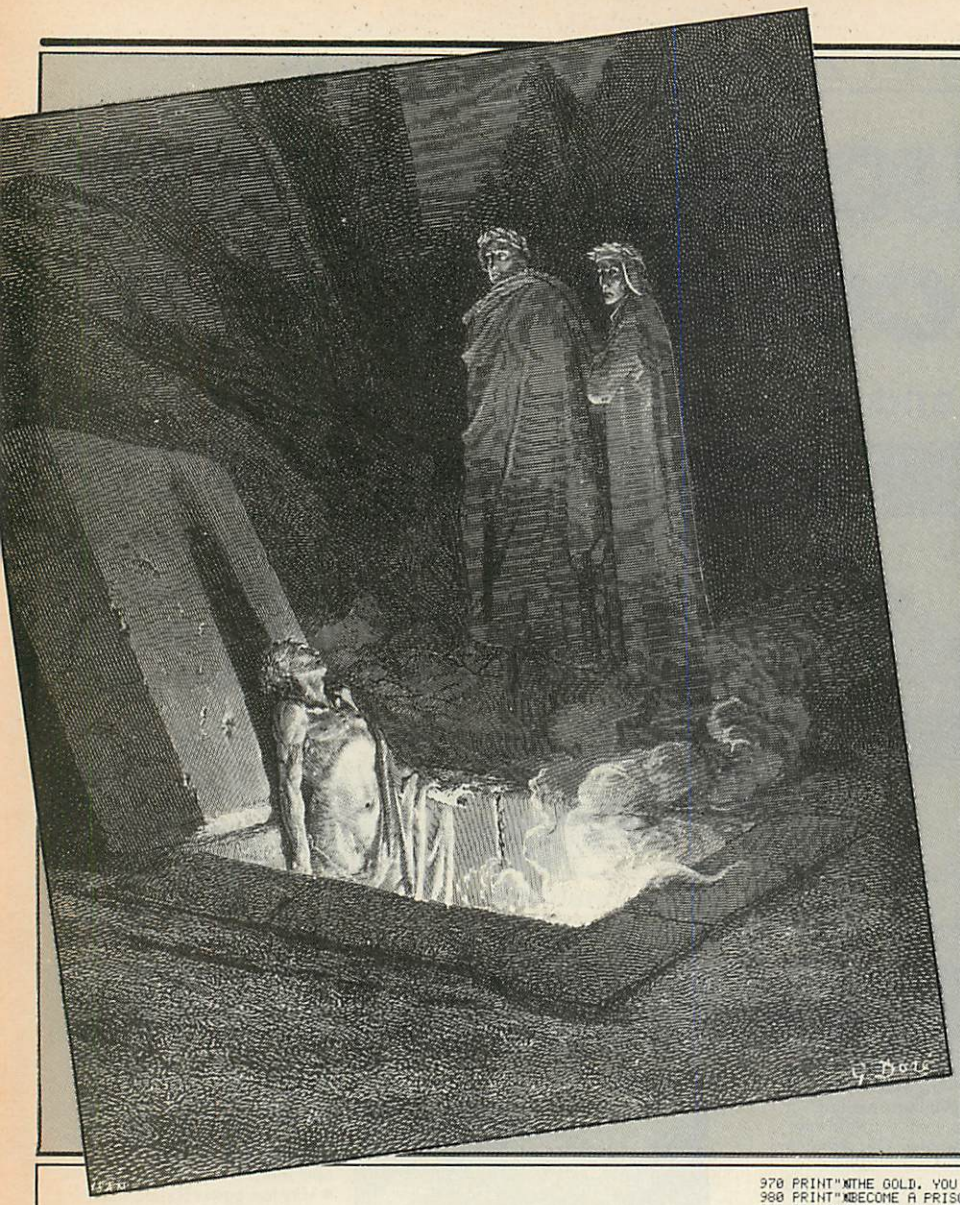
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Name _____

Address _____

_____

Post to: Ricoll Electronics Limited, 48 Southport Road, Ormskirk, Lancs, L39 1QR
Please allow 28 days for delivery



(continued from page 140)

seconds to draw maze 3. The maze is stored in the unused 4K block of memory beginning at $C000 hex — 49152 decimal.

The maze is presented to you on a 5 by 5 grid, with the centre square being where you are currently standing in the maze. You are represented in the middle of the screen by a multi-colour mode sprite. This sprite changes depending on whether you are carrying the sword, the gold or nothing.

To move around the maze, you can use a joystick in central part 2, or the keys:

T — Up
F — Left
H — Right
V — Down

When you move around the maze, you do not actually move around but, but the maze moves around you.

The number of monsters and swords in each maze depends on the size of the maze.

Maze 1 — 15 monsters : 15-19 swords
Maze 2 — 20 monsters : 20-24 swords
Maze 3 — 25 monsters : 25-29 swords

When typing in the masses of Data statements, I suggest that you Save them on to tape first before Running it because any mistakes in the Data statements might cause the machine to crash.

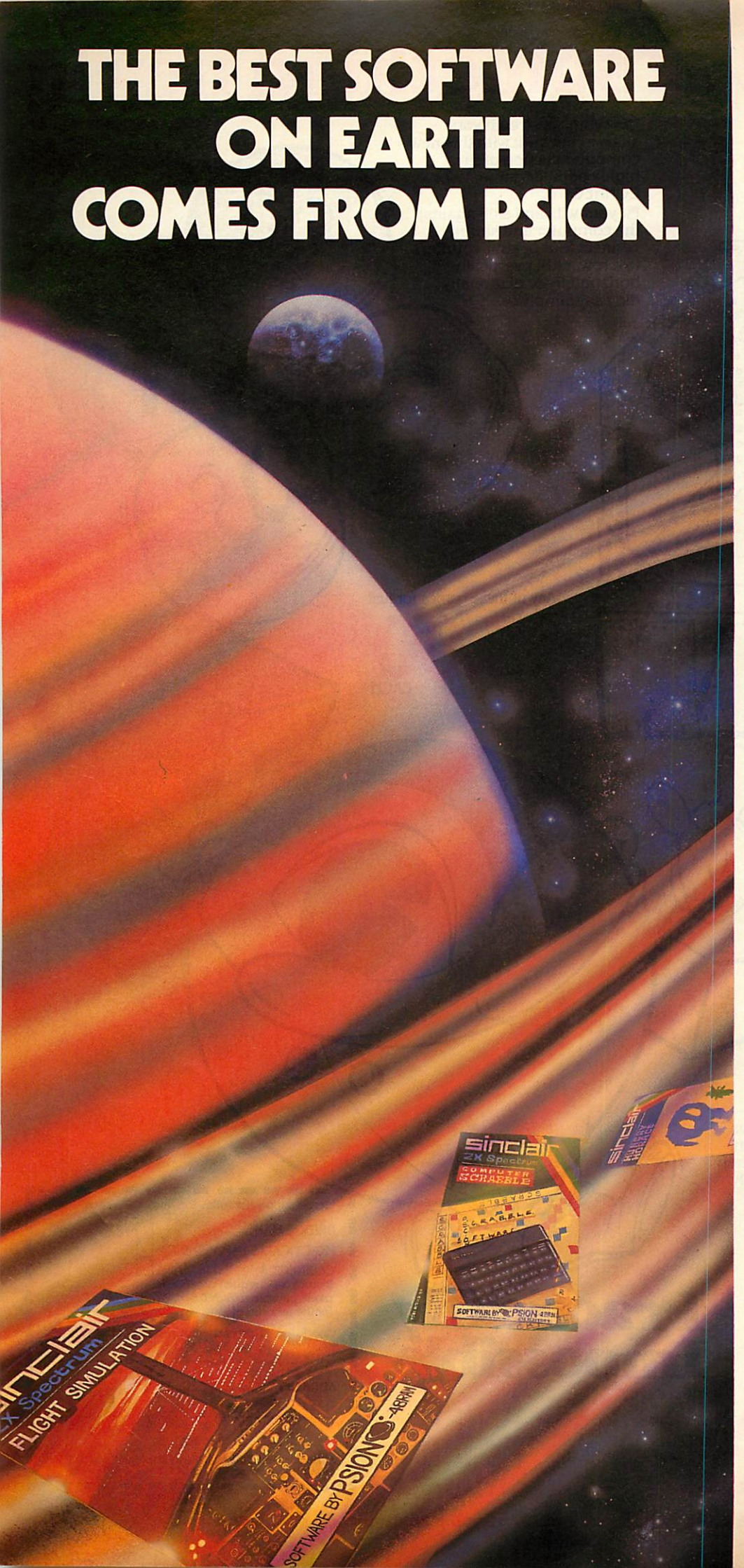
To make sure that the Data has been typed in correctly, or to be 99 per cent sure, you can Run 20000.

This will add up all the Data and check the total with what it should be. If the total is not equal to it, then you are told that there is an error in Data, otherwise you are told that the Data is OK. This check might not work if you have made more than one mistake in the Data as the totals of the numbers may be the same as they would be if the Data was correct.

(listing continued from page 140)

```
297 FORG=1TO23:PRINTTAB(25)"□■□":NEXT
298 PRINTTAB(25)"□■          ■":NEXT
299 FORG=2009TO2023:POKEG,160:POKEG+54272,14:NEXT:POKEO+21,1
300 POKE823,INT(0/256):POKE822,0-PEEK(823)*256:SYS38057:MO=MO-1:IFMO<=0THEN800
301 POKE4,INT(RND(1)*4):SYS40800:SYS38057:IFPEEK(0)=100THEN900
302 C=0:VV=PEEK(56320):V=PEEK(197):GETH$:IFH$="■"THEN350:REM TYPE F1
305 IFV=220RVV=126THENC=-IN:GOTO310
306 IFV=210RVV=123THENC=-1:GOTO310
307 IFV=310RVV=125THENC=IN:GOTO310
308 IFV=290RVV=119THENC=1:GOTO310
309 GOTO301
310 W=PEEK(O+C):IFW=25THEN301
311 IFW=0THENO=O+C:GOTO300
312 IFW=150THENTR=1:POKEO+C,(25ANDSW=0)OR(50ANDSW=1):SW=0:GOTO410
313 IFW=50ANDSW=0THENSW=1:POKEO+C,(25ANDTR=0)OR(150ANDTR=1):TR=0:NS=NS-1:GOTO40
0
314 IFW=75THEN1000
315 IFW=100THENO=O+C:POKE823,INT(O/256):POKE822,O-PEEK(823)*256:SYS38057:GOTO90
0
316 IFW=175ANDTR=1THEN500
317 GOTO301
350 POKE198,0:POKE53280,0
360 GETR$:IFR$<>"■"THEN360:REM TYPE F1
370 POKE198,0:POKE53280,14:GOTO301
400 POKE2040,14:POKEO+38,8:GOTO301
410 POKE2040,15:POKEO+38,8:GOTO301
500 FORG=1TO500:NEXT
510 POKE53280,0:POKE53281,0:POKEO+21,0
520 PRINT"□□□□WELL DONE!!! YOU HAVE SUCCEEDED IN YOUR □QUEST FOR THE GOLD."
525 RT=INT(MO/(MA-HI*4)*100+0.5):POKE198,0
530 PRINT"□□YOUR RATING IS";RT
540 IFRT>H(5)THEN550
545 GOTO982
550 INPUT"□YOUR NAME";IN$
555 IFIN$=""ORLEN(IN$)>10THENPRINT"□!!!":GOTO550
560 H(5)=RT:H$(5)=IN$
562 FORI=1TO4
564 IFH(I)>=H(I+1)THEN570
565 P=H(I):H(I)=H(I+1):H(I+1)=P:P$=H$(I):H$(I)=H$(I+1):H$(I+1)=P$:V=1
570 NEXT
575 IFV=1THENV=0:GOTO562
580 GOTO982
800 POKEO+21,0:FORH=1TO15:PRINT"□□□"TAB(26)"□□NO MORE MOVES"
810 FORG=1TO100:NEXT
820 PRINT"□□□"TAB(26)"□
830 FORG=1TO100:NEXTG,H
840 GOTO960
900 POKEO+21,0:FORJ=1TO500:NEXT
905 IFSW=1THENPOKEO,0:SW=0:MO=MO+UG:NM=NM-1:POKEO+38,0:POKEO+21,1:GOTO300
906 IFRND(1)>0.75THENPOKEO,0:NM=NM-1:MO=MO-UG:POKEO+21,1:GOTO300
910 E$="□□□□□□□□□□□□□□□□□□□□□□□□□"
920 FORG=1TO10:PRINTE$"□□DEATH■":NEXT
930 FORH=1TO100:NEXT
940 PRINTE$"     "
950 FORH=1TO100:NEXTH,G
960 POKE53280,0:PRINT"□□□□YOU HAVE FAILED IN YOUR ATTEMPT TO GET"
970 PRINT"□THE GOLD. YOU GET A RATING OF ZERO AND"
980 PRINT"□□BECOME A PRISONER IN THE MAZES OF HELL."
982 PRINT"□□□"TAB(10)"CURRENT TOP RATINGS":PRINTTAB(10)"□======= === =======□"
984 FORI=1TO5:PRINTTAB(7);"▙";I;TAB(14);"□";H$(I);TAB(28);"■";H(I):NEXT
999 FORG=1TO1000:M(G)=0:NEXT:GOTO41
1000 POKEO+21,0:I#="MOVES LEFT":MO=MO-UG:PR=PR-1:GOSUB268
1005 PRINT"□□□■■■■■■THIS REPORT COSTS YOU"UG"MOVES"
1010 PRINT"□□■■■■■■■■HIT A KEY TO RETURN TO GAME■"
1020 POKE198,0:WAIT198,1:POKE198,0
1030 POKEO+C,25:GOTO296
10000 DATA169,192,133,252,169,0,133,251,169,25,145,251,24,165,251,105,1,133
10001 DATA251,165,252,105,0,133,252,201,208,208,235,96
10002 DATA169,0,133,4,160,0,189,124,146,145,253,189,136,144,145
10003 DATA251,232,200,192,5,208,240,24,165,253,105,40,133,253,165
10004 DATA254,105,0,133,254,24,165,251,105,40,133,251,165,252,105
10005 DATA0,133,252,230,4,165,4,201,5,208,204,96,162,0,160
10006 DATA0,142,52,3,24,173,54,3,125,62,3,133,251,173,55
10007 DATA3,105,0,133,252,177,251,141,53,3,189,208,157,133,253
10008 DATA189,52,158,133,254,189,152,158,133,251,189,252,158,133,252
10009 DATA174,53,3,32,112,148,174,52,3,160,0,56,173,54,3,253,62
10010 DATA3,133,251,173,55,3,233,0,133,252,177,251,141,53,3
10011 DATA189,64,156,133,253,189,164,156,133,254,189,8,157,133,251
10012 DATA189,108,157,133,252,174,53,3,32,112,148,174,52,3,232
10013 DATA224,12,208,144,96
10014 DATA160,2,160,2,160,2,160,2,160,2,160,2,170,1,170,1,170,1,160,2,160,2
10015 DATA170,1,170,6,170,1,160,2,160,2,170,1,170,1,170,1,160,2,160,2,160,2,160,2,160
10016 DATA2,160,2,160,2
10017 DATA205,8,160,8,160,7,160,8,206,8,160,8,170,3,170,3,170,3,160,8,160,7
10018 DATA170,3,214,3,170,3,160,7,160,8,170,3,170,3,170,3,160,8,206,8,160,8,160
10019 DATA7,160,8,205,8
10020 DATA112,13,64,13,64,13,64,13,110,13,93,13,160,10,160,10,160,10,93,133
10021 DATA93,13,160,10,160,10,160,10,93,13,93,13,160,10,160,10,160,10,93,13
10022 DATA109,13,64,13,64,13,64,13,125,13
10023 DATA236,1,160,4,102,6,160,4,251,1,160,4,105,4,32,0,95,4,160,4,102,6,64,3
10024 DATA64,3,91,3,102,6,160,4,223,4,32,0,233,4,160,4,252,1,160,4,102,6,160,4
10025 DATA254,1
10026 DATA102,1,160,2,170,1,160,2,102,1,160,2,236,3,160,3,251,3,160,2,170,1,160
10027 DATA3,209,3,160,3,170,1,160,2,202,3,192,3,203,3,160,2,102,1,160,2,170,1
10028 DATA160,2,102,1
10029 DATA127,2,104,4,104,4,104,4,255,2,85,6,209,7,160,7,209,7,73,6,74,6,160,7
10030 DATA215,7,160,7,75,6,32,0,95,7,192,7,105,7,32,0,255,2,32,0,32,0,32,0,127,
2
10031 DATA160,0,162,0,189,180,145,133,253,189,181,145,133,254,177
10032 DATA253,201,100,240,19,230,4,165,4,201,4,208,4,169,0
10033 DATA133,4,232,232,224,50,208,222,96,169,0,145,253,164,4
10034 DATA185,120,145,141,130,145,160,0,165,4,201,0,240,45,201
10035 DATA1,240,4,201,2,240,37,56,165,253,237,130,145,133,253
10036 DATA165,254,233,0,133,254,177,253,201,0,208,17,169,100,145
10037 DATA253,165,253,157,130,145,165,254,157,181,145,24,144,172,24
10038 DATA165,253,109,130,145,133,253,165,254,105,0,133,254,177,253
10039 DATA201,0,208,199,201,0,240,215
10040 DATA0,16,0,48,84,0,49,169,0,49,169,0,48,168,0,48,168,0,252,32,0,50,86,0,5
0
10041 DATA70,0,2,86,0,10,70,0,0,86,0,0,69,0,0,84,0,0,136,0,0,136,0,0,136,0,0,13
6
10042 DATA0,0,136,0,2,138,0,0,0,0
10043 DATA0,16,0,0,84,0,1,169,0,1,169,0,0,168,0,0,168,0,0,32,0,2,86,0,11,71,128
10044 DATA47,87,224,47,71,224,11,87,128,2,70,0,0,84,0,0,136,0,0,136,0,0,136,0,0
10045 DATA136,0,0,136,0,2,138,0,0,0,0
20000 FORG=1TO756:READA:C=C+A:NEXT:RESTORE
20001 IFC<>74851THENPRINT"□■ERROR IN DATA□":END
20002 PRINT"□■DATA O.K.□"
```

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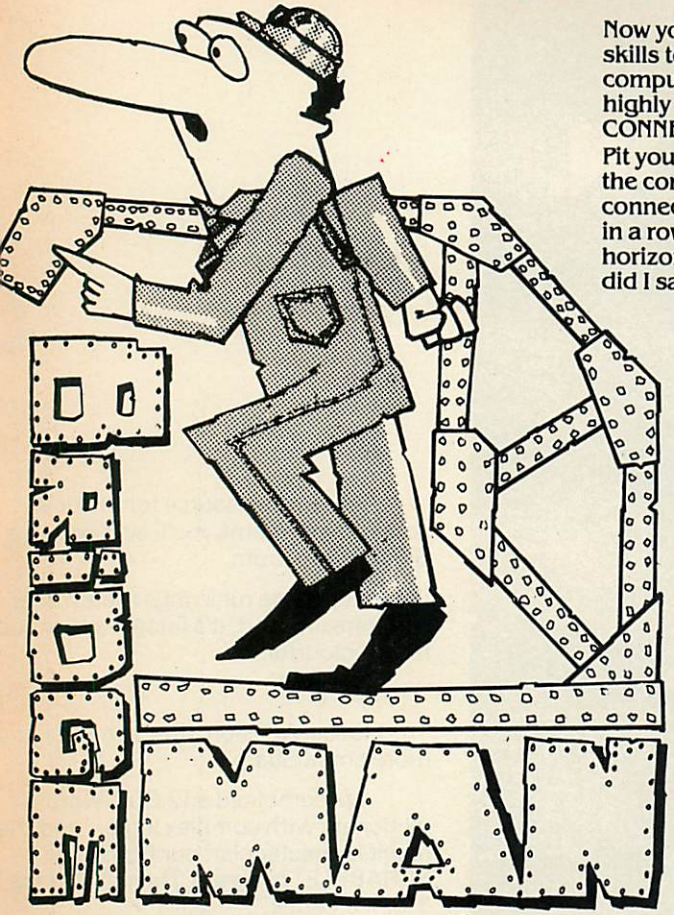
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In fact, if you're choosing software for your Spectrum, there's just one way to find the best...

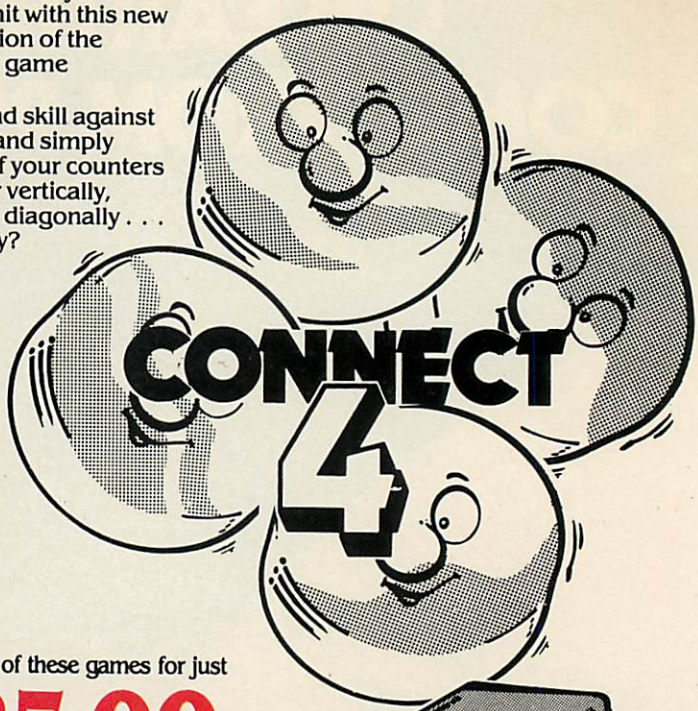
Look for the Psion symbol on the cover of the cassettes.

PSION

The start of something new!!



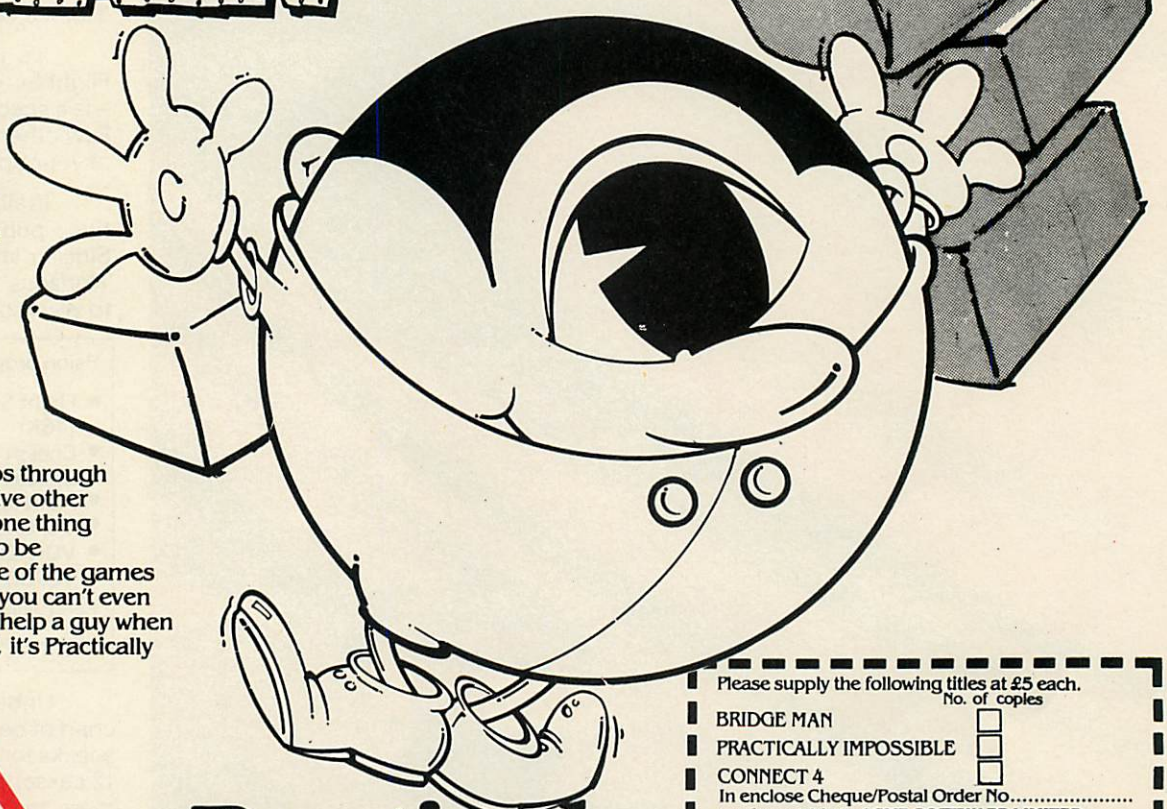
Now you can stretch your skills to the limit with this new computer version of the highly popular game CONNECT 4.
Pit your wits and skill against the computer and simply connect four of your counters in a row, either vertically, horizontally or diagonally . . . did I say simply?



Any of these games for just

£5.00 EACH

You built the bridge and the responsibility is all yours. As bridges go it's not a bad job. Only one snag, due to a shortage of building materials there is only one section left and six gaps to fill. The Boss is on his way to inspect the job, can you juggle the single section around quickly enough so that he won't notice the gaps? It ain't going to be easy.



Can you steer your Silly Cyclops through the Barrier and then through five other mind-boggling games? Only one thing you can be sure of, it's going to be Practically Impossible. In some of the games Silly Cyclops closes his eye so you can't even see him. How on earth do you help a guy when you can't see him? As I've said, it's Practically Impossible . . . .

Practically Impossible

Please supply the following titles at £5 each.

	No. of copies
BRIDGE MAN	☐
PRACTICALLY IMPOSSIBLE	☐
CONNECT 4	☐

In enclose Cheque/Postal Order No.....
made payable to ACME SOFTWARE LIMITED,
for the amount of £.....

Goods to be despatched by return of post.

NAME.....

ADDRESS.....

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.....POSTCODE .....

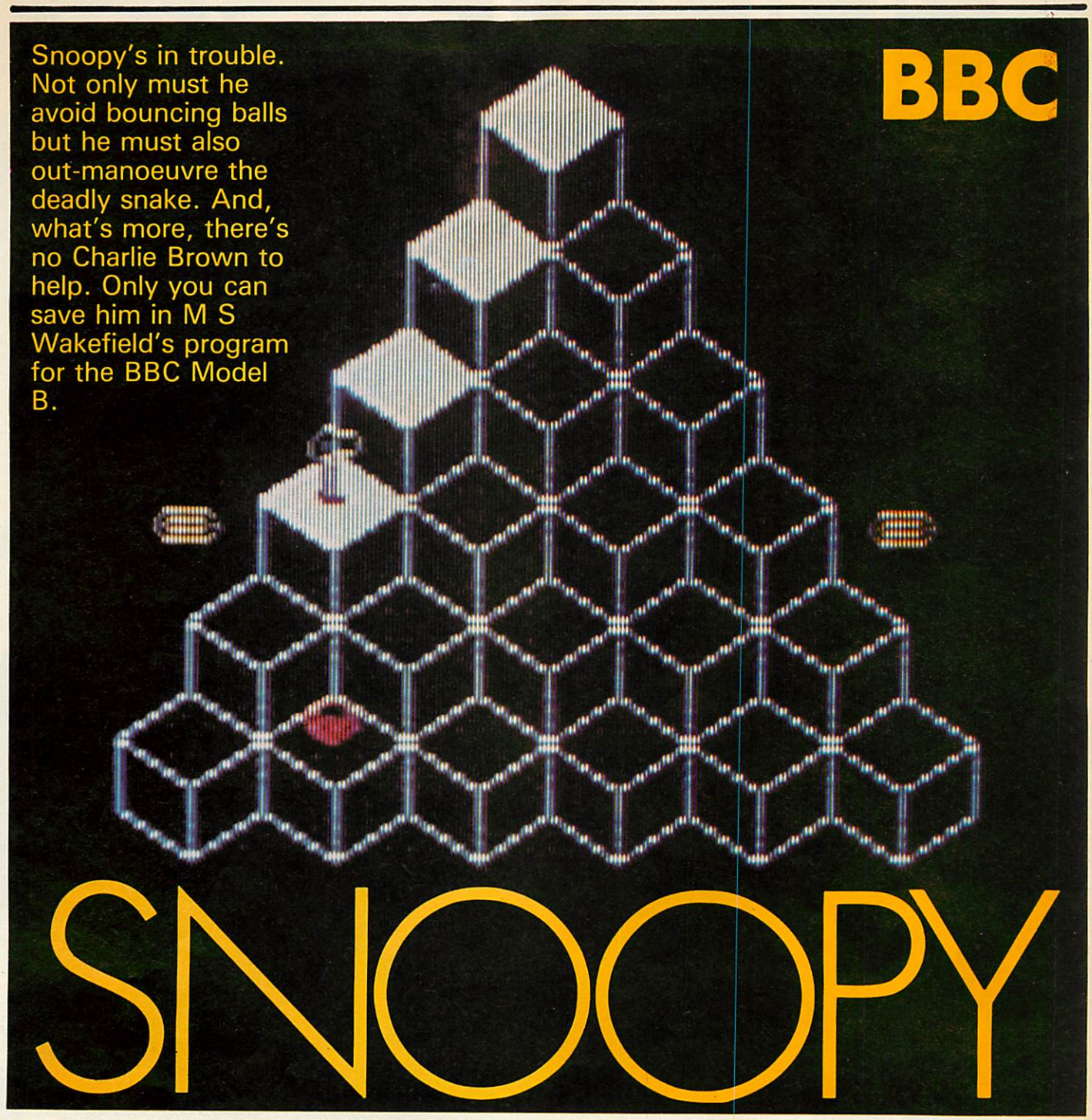
ACME SOFTWARE LIMITED, 49/51 The Albany, Old Hall St., Liverpool, Merseyside, L3 9EJ. Tel: 051-236 8062

ACME

Acme Software Limited, 49/51 The Albany, Old Hall Street, Liverpool, Merseyside, L3 9EJ. Telephone: 051-236 8062.

Snoopy's in trouble. Not only must he avoid bouncing balls but he must also out-manoeuvre the deadly snake. And, what's more, there's no Charlie Brown to help. Only you can save him in M S Wakefield's program for the BBC Model B.

BBC



SNOOPY

QUICK! JUMP ONTO another cube to avoid one of the relentless bouncing balls! But no! The dreaded springing serpent has emerged from the strange ball awaiting its chance at the bottom, and you must leap for a lift before he heads you off. He falls over the edge of the pyramid as you soar back towards the top on the elevator. That gives you a bit more time to fill in some of the cubes of which the pyramid is comprised.

For this is the idea of this new arcade game — your task is to jump onto each cube of the pyramid while avoiding the hazards. First, there are the remorseless bouncing balls, which tumble down the pyramid, deadly if not immediately assessed and nimbly avoided. The first ball is of a different colour and mission to the following ones — as it contains the notorious snake.

This ball waits at the bottom — awaiting its opportunity — until finally it vanishes leaving the snake, the second hazard. This follows you unremittingly. The only thing for it is to wait by one of the two lifts, until it is almost on you, and then jump onto the lift. The snake then follows you over the edge and falls to its death in the depths below. But this is not the last of the feared snakes as the next of the incessant balls changes colour and bears yet another.

When at last all the cubes have been visited, another layer with a whole new spectrum of colours is attained and as the layers progress, difficulty is increased. After three layers are completed, each cube must be visited twice before its top is filled.

Program 1.

```
  5VDU28,0,0,39,24
 10CLS:FORA=1TO2:PRINTCHR$(141);CHR$(129);CHR$(157);
CHR$(131);"     Instructions for Cubert":NEXTA
 20PRINT:PRINT:PRINT"CONTROLS:  'T'-UP LEFT"
 30PRINT:PRINT"                 'Y'-UP RIGHT"
 40PRINT:PRINT"                 'U'-DOWN LEFT"
 50PRINT:PRINT"                 'B'-DOWN RIGHT"
 60PRINT:PRINT"MISSION:  Fill all cube tops."
 70PRINT:PRINT"ENEMIES:  Bouncing Balls,Snake."
 80PRINT:PRINT"TACTICS:  Avoid balls."
 90PRINT"          Lure snake over edge by
    attracting it and then                jumping
on lift."
100VDU28,10,24,30,21
110CHAIN"Cubert"
```

First type in program 1, and Save it as "CUBERT". This gives instructions to the game including keys to use, a brief rundown of the game and tactics to apply. Program 2 is then typed in, and Saved after program 1 as "Cubert". In future, when the first program is Chained, the second one will be Loaded and Run automatically.

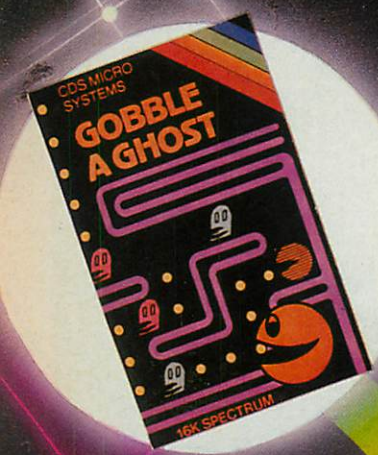
This program is a full clear arcade-action game which fully uses the colours and Modes of the BBC Model B, including palette changes to employ all eight colours in conjunction with the high resolution of Mode 1. Also, using GCOL 3,X to EOR the existing colours smooth non-flicker pixel animation is obtained. The program includes full enjoyment of Envelope and sound channel 0, and

(continued on page 151)

CDS Breaks t

Can you coordinate mind, hand and eye in an instant . . . stay cool in the face of unknown dangers and nerve-tingling challenge . . . fight on and win against tremendous odds? You can? Then you're ready for CDS, the games that take you further than you've ever been before.

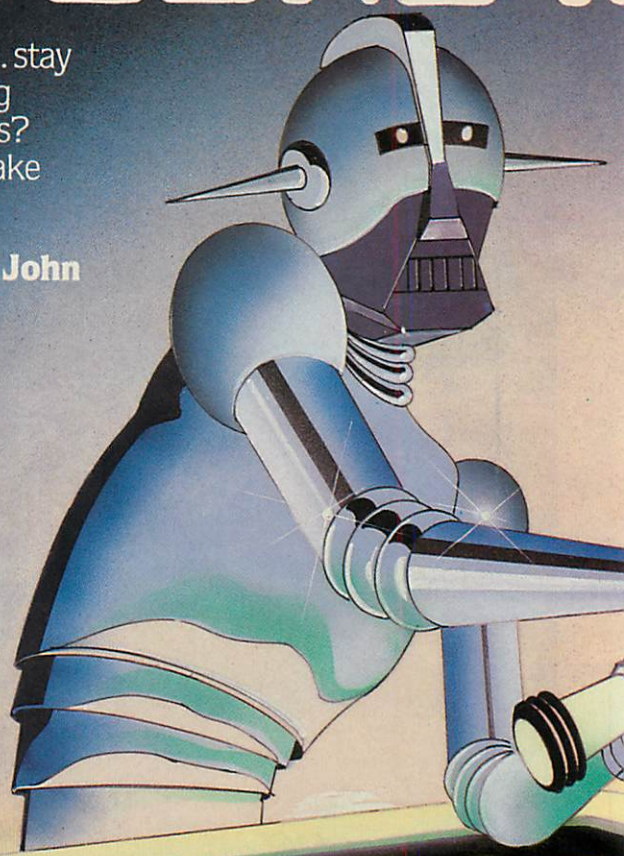
Yours for only £5.95 each at W. H. Smith, Boots, John Menzies and other leading computer stores.











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Will *you* survive the challenge?

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TRADE ENQUIRIES WELCOME

ne skill barrier!



For 16K and 48K SPECTRUM

CRL OPENS UP A WORLD OF MYSTERY



DERBY DAY for the 48K Spectrum **Only £5.95**
Gambling on any horse in the field, up to 5 players can lay bets with Honest Clive Spectrum the bookmaker. Watch the race begin as the tape lifts and marvel at the amazingly realistic 3D animation as the riders jockey for position. See the slow motion finish. Sound and colour used to its fullest in this 44K of superb programming. Not recommended for compulsive gamblers.



CAVEMAN for any ZX Spectrum **Only £4.95**
Enter the prehistoric world and discover the difficulties our forefathers had in obtaining food. The idea of the game is to pick your way across monster infested plains, and through treacherous mountain ranges to reach the Pterodactyl's lair.



STARGAZER SECRETS for the 48K Spectrum Only £5.95

The only serious Astrological forecaster produced for the 48K ZX Spectrum. Written by a professional Astrologer, it condenses Astrology's complex mathematics and relations into an easy to use program. By entering the subject's name and date, time and place of birth, the program quickly interprets the data, plots a Natal Chart and lists the results under a number of categories. A program that combines the newest art with the oldest Science.



CRAWLER for any ZX Spectrum **Only £4.95**
An addictive chase game needing both reaction and strategy. In fast machine code for arcade action.
You are Crawler and your aim in life is to hunt down and devour as many bugs as you can. Every time you catch one you grow longer, so that you soon have to avoid biting yourself. The more bugs you eat, the more difficult it becomes. You can choose between 9 skill levels.



JACKPOT for the 48K Spectrum **Only £4.95**
A complete simulation of a popular fruit machine, using definable graphics to the fullest. It contains a complete introduction to the rules of its HOLD, NUDGE, GAMBLE and FEATURE BOX with animated demo. Memory mapped reels, simultaneous revolution, staggered stop, animated bet and payout, payout board and realistic sound effects recreate the original. A must and a wallet saver for any fruit machine buff.



TEST MATCH for the 48K Spectrum **Only £5.95**
This is the No. 1 hit of the Summer and is a 3-D Test Match Cricket Simulation. Contains two programs – the first a full 5-day Test, the second a selection of one day matches. Each program contains a full scoreboard and definable teams. The game already contains England and Australia teams.

EXCITEMENT AND INTRIGUE.



RESCUE for the 48K Spectrum **Only £5.95**
An adventure game that needs a Special Program to detail its Rules! VERY simply, you must find the Map and Radio Men, plot your route and monitor patrols as they scour the 40+ locations you are travelling through. If you have the right equipment you can cross into Secret Territory in search of the Castle containing the imprisoned Princess. If you find the Princess, you must still return to base with her.

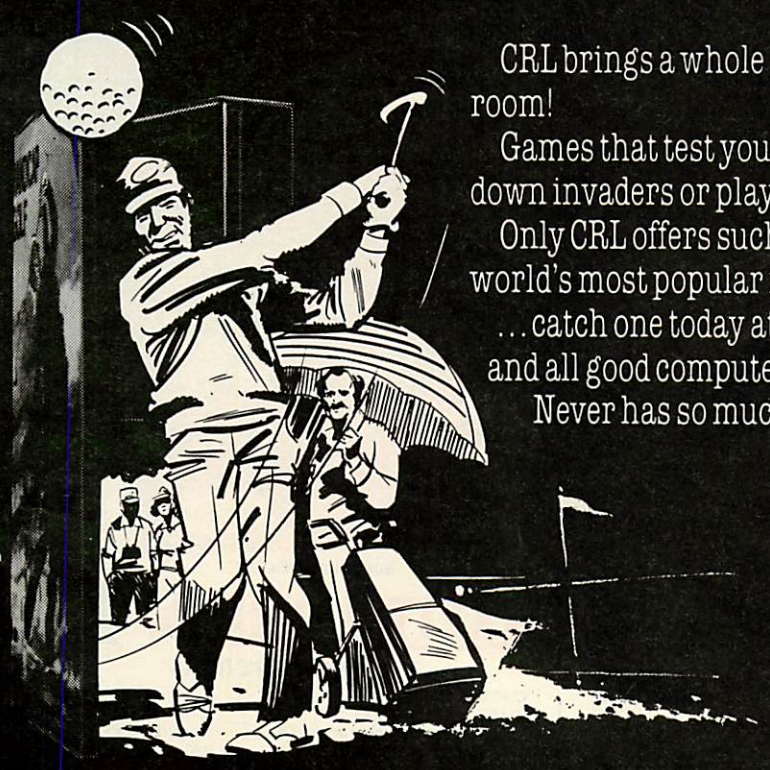


LUNAR RESCUE for any ZX Spectrum **Only £4.95**
A fast moving addictive program. In this game you are the pilot of a spaceship with orders to rescue stranded Astronauts from the Moon's ragged surface. Six astronauts are relying on you to save them, but you can only take one at a time. You will have to steer your craft through treacherous asteroid belts surrounding the moon.



3-D DESERT PATROL for any ZX Spectrum **Only £4.95**

A game of Strategy and reaction in 3 dimensions. You are the commander of a heavily armoured tank rumbling towards safety. You must avoid mines and enemy tanks. Your colour coded mine indicator will aid you across the dangerous enemy fields. Once across, you are vulnerable to enemy attack with only 50 shells available for retaliation.



CRL brings a whole new world of excitement right into your living room!

Games that test your skills to the ultimate – whether it's zapping down invaders or playing a whole game of cricket.

Only CRL offers such a wide choice of computer programs for the world's most popular micros.

... catch one today at Menzies, Boots, W. H. Smiths, Spectrum Group and all good computer shops or send direct to CRL.

Never has so much excitement been contained in a cassette!

John Menzies Boots WHSMITH spectrum

HANDICAP GOLF for the Dragon 32 **Only £6.95**
An 18 hole, 1 or 2 player handicap game. There are Bunkers, the Rough, Lakes, Trees, gorse bushes and gusting wind which all have to be taken into account as you choose the strength and direction of your shot. The Computer decides the length of the hole and its par, making sure that you never, EVER play the same hole twice. Watch the Dragon 32 build up the hole in a fascinating graphics routine. Full use of sound and colour.

HANDICAP GOLF for any 48K Spectrum **Only £5.95**
Amazing, 3-D graphics on a memory mapped course, this program has over 250 user definable graphics to produce a startlingly realistic simulation. You have a selection of 15 clubs and a caddy. Each green is automatically enlarged when putting commences. The graphics have to be seen to be believed. You'll wish you had a swing as good as the cartoon golfers. There's even a 19th hole.

CRL

140 Whitechapel Road London E1

LOTHLORIEN

WARMASTER SERIES

THE WINNING NAME IN WAR GAMES

3 NEW STRATEGY GAMES FROM THE FAMOUS WARMASTER SERIES

Johnny Reb (1861)

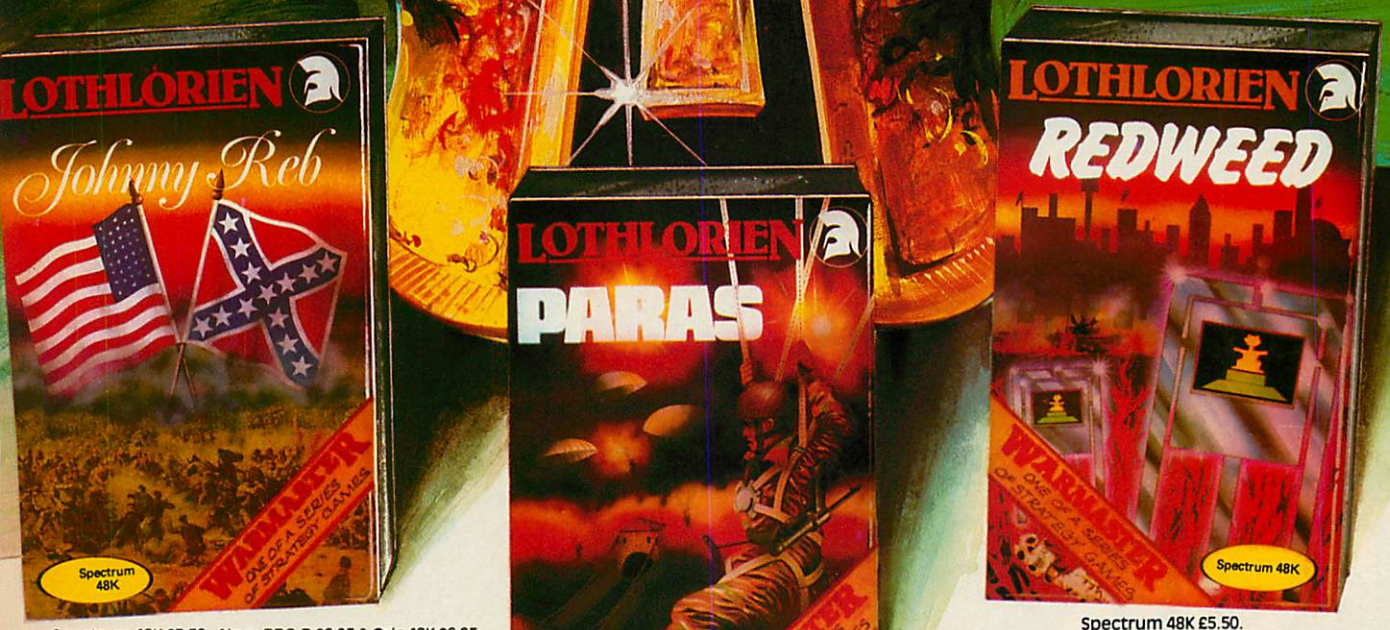
There's still plenty of fight left in the Confederate South as each side selects forces to manoeuvre on a full-graphics battle field. Use the 'save game' facility to perfect your tactics and re-write American History. 1 or 2 players.

PARAS (1944)

Dramatic all-graphics reconstruction of a famous World War II Campaign. Your hand-picked force has dropped behind enemy lines to capture a strategic river crossing. 2 versions of the game with ten levels of play.

REDWEED (1995)

The Martians are coming in this superb all-graphics battle. You're in command of land forces defending London when an outbreak of semi-sentient Redweed threatens to immobilize your forces. Fifteen levels of play.



Spectrum 48K £5.50. New-BBC-B £6.95 & Oric 48K £6.95.

BBC-B £6.95 New-Spectrum 48K £5.95.

Spectrum 48K £5.50.

MORE SUPERB STRATEGY GAMES FROM LOTHLORIEN

WARMASTER TITLES

Warlord	48K Spectrum/Dragon 32 Tandy Color 32K/ZX 81 16K
Roman Empire	16K Spectrum/BBC-B/Dragon 32 Tandy Color 32K/ZX 81 16K Atari 400/800 48K
Peloponnesian War	ZX 81 16K
Battlezone 2000	BBC-B

OTHER GAMES

Tyrant of Athens	16K Spectrum/Dragon 32/Tandy Color 32K/ZX 81 16K
Samurai Warrior	16K Spectrum/Dragon 32/ZX 81 16K
Privateer	48K Spectrum/ZX 81 16K combined cassette £4.50

Prices:				
	ZX 81	£4.50	Dragon 32	£6.95
	Spectrum (except Paras)	£5.50	BBC-B	£7.95
		£5.95	Tandy	
			Atari	£12.50

With one of the most mind-stretching selections of strategy games in the UK, Lothlorien have justifiably earned the name of 'Warmasters'.

New titles are added or extended every month. Lothlorien are always interested in hearing from programmers with first class software that satisfies the high standard that the market now demands.

Lothlorien games are available from most leading software specialists or direct by post at no extra cost. Why not really put your computer through its paces today?

LOTHLORIEN

the mind stretcher

Please send me: (Tick box)

REDWEED	PARAS	JOHNNY REB
Spectrum 48K £5.50 ☐	Spectrum 48K £5.95 ☐	Spectrum 48K £5.50 ☐
	BBC-B £6.95 ☐	BBC-B £6.95 ☐
		Oric 48K £6.95 ☐

Others (please specify) _____

I enclose a cheque/PO for £____ made payable to M. C. Lothlorien

Please debit my Access A/C No. ____/____/____/____

SIGNED _____

ADDRESS _____

Send to: M. C. Lothlorien, Dept. YC/10/83, 56a Park Lane, Poynton, Cheshire SK12 1AE.

Access

sinclair special 5



Inside... New Interface 2 and ROM cartridges! New Software!

TAKING NEW SOFTWARE IN NEW DIRECTIONS

You'll see that this issue of Sinclair Special devotes considerable space to software. Why, when we've so much to say about hardware and peripherals? Simply because at Sinclair we believe in supporting first-class hardware with first-class software.

This month sees the start of a new commitment to education in our catalogue, both for adults and children.

In the field of micro theory, we've programs like Beyond BASIC and Make-a-Chip, which take you from the creation of simple ZX® assembler subsets to simulated circuit design projects.

There's Musicmaster, to teach you music terminology, note values and composition.

And if you're keen to beat your Spectrum at chess (which can be hard), you'll certainly want to try Chess Tutor 1, the first program in a complete chess masterclass.

Coming soon...

In the pipeline are many new releases, some of which break completely new ground. LOGO and micro-PROLOG for instance. They're fifth generation languages which will take you and your Spectrum closer than ever before to the creation and application of artificial intelligence.

A formal agreement between Sinclair and Macmillan Education has been announced, the first results of which will be published this autumn. These consist of five programs in a complete early reading course plus the first four of a series of programs based on Macmillan's top selling Science Horizons Scheme. All programs are designed for use in schools or the home.

And with Blackboard software, we're publishing six more home education programs for primary school children. Covering alphabet, spelling and punctuation, each of these programs is a true gem, unlike any other education software, and fascinating to run. Even for adults!

I believe that these new titles represent a major advance in educational software for the home.

New ROM software too!

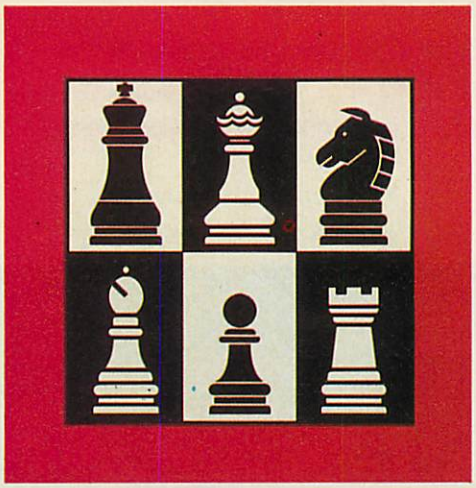
You may well have heard news of ZX Interface 2® and ROM cartridge programs. You'll find full details of the Interface and its software on the facing page (and there's an order form on the back page too!). These offer an instant games playing facility at unbeatable prices, and expand the possibilities of using your Spectrum in yet another direction.

Alison Maguire

Alison Maguire
Applications Software Manager

SOFTWARE UPDATE

The latest cassette software for ZX® Computers



Chess Tutor 1

For 48K RAM Spectrum. **£9.95.**

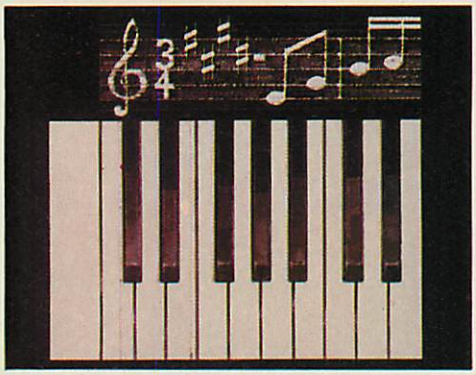
Chess Tutor is a new way of learning all about chess – using your ZX Spectrum.®

It starts from the beginning by teaching you about the chess pieces and the way they move – including castling, en passant, promotion, check, checkmate, stalemate and perpetual check.

Then it teaches you the basic tactics – pins, forks, double attacks and skewers.

There are over 120 exercises and over 200 questions for you to answer – with demonstrations and hints from your ZX Spectrum when you want them.

You can choose which parts of the course you want – and even experienced players may be surprised at what they can learn from Chess Tutor.



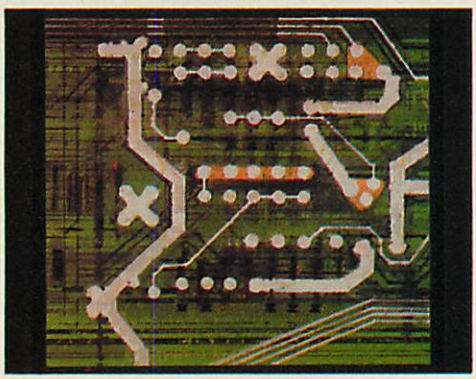
Musicmaster

For 48K RAM Spectrum. **£9.95.**

Musicmaster turns your ZX Spectrum into a musical instrument which will not only play tunes, but will also demonstrate key signatures, durations of notes, and scales.

You can write your own tunes – in any key – play them over and over again, save them on tape, modify them.

You can either write your music on a stave, or place a simple overlay on your Spectrum for a 17-note keyboard.



Make-a-Chip

For 48K RAM Spectrum. **£9.95.**

Make-a-Chip teaches you the basic elements of circuit design, shows you how they fit together, and then lets you design and test your own circuits.

When you have designed a circuit, you can give it inputs and outputs and your ZX Spectrum will check it for you. Then it will run it, or tell you what's wrong so that you can modify it.

Make-a-Chip is a fascinating way of finding out how computer logic works.

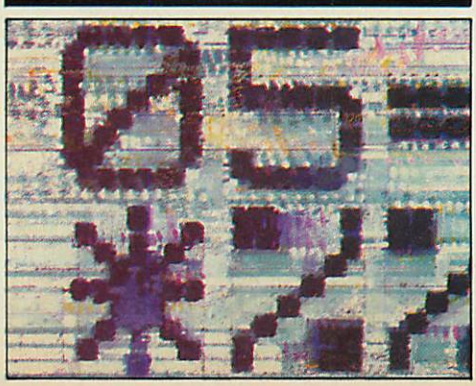


Print Utilities

For 16K and 48K RAM Spectrum. **£9.95.**

Increase the printing and display facilities of your ZX Spectrum with the Print Utilities program.

Print Utilities enables you to enhance your programs by generating characters of eight different sizes which you can place anywhere on your screen.



Beyond BASIC

For 48K RAM Spectrum. **£9.95.**

Takes the agony out of assembler. Takes the mystery out of machine code.

Beyond BASIC gives you a deeper insight into the workings of your ZX Spectrum. It explains what happens inside your micro when you run a program, and it teaches you simple Z80 machine code programming.

A major feature of Beyond BASIC is that it enables you to write your own Z80 assembler programs – then you can actually see on your screen how they affect the ZX Spectrum memory and registers.

ZX INTERFACE 2®

The New ROM Cartridge/Joystick Interface

Loads programs instantly!
Takes two joysticks!
Just plug-in and play!



SEE BACK PAGE FOR ZX INTERFACE 2 AND ROM CARTRIDGE ORDER FORM!

The ZX Interface 2 is the latest new peripheral for the ZX Spectrum® system. It enables you to use new ZX® ROM cartridge software: plug-in programs that load instantly. It allows you to use two standard joysticks, without the need for separate, special interfaces.

To use new ZX ROM cartridge programs, just connect Interface 2 to the rear of your Spectrum or Interface 1 and plug in the cartridge of your choice. The program is then loaded, ready to run!

You can use any joystick that has a 9-way D plug. Use one or two of them for extra fun with ZX ROM cartridge or Sinclair cassette programs – or with dozens of other Spectrum-compatible programs!

...AND BRAND NEW ROM CARTRIDGE SOFTWARE!

There's already plenty of choice of ZX ROM cartridge programs for your Spectrum. Some are old favourites, in an exciting new form. Others are new.

And now, thanks to ROM cartridge technology, you can run them *all* on a 16K RAM Spectrum, even if they were originally written only for 48K machines!

Every ROM cartridge program loads fast and faultlessly. No wires, no waiting, no worries about loading errors! All of them are affordably priced too, at £14.95.

Backgammon



Everything you need to play the famous and deceptively simple board game. Board, stones, rolling dice and doubling dice are shown in full colour and high resolution. Choose from four levels of skill to suit experts and beginners alike – full rules are included.

Space Raiders



Your skill is all that's stopping successive waves of aliens from destroying Earth. Use your gun base to attack. Shelter behind buildings... move out and blast the passing alien soaceship!

Full-colour high-resolution graphics with sound.

New! PSSST



Robbie the Robot sits in his garden. Help him fetch compost to cultivate his prize Thyrgodian Megga Chrysanthodil. Help him make the right choice of pesticide, to ward off devilish insects. Stop the insects breeding to overwhelming numbers before Robbie's plant has bloomed. PSSST is horticulture with a horrendous twist!

One and two player option, with a host of features including sound effects.

Chess



This sophisticated program does everything you'd expect at board game level, and much more besides.

The high-resolution chessboard and pieces are arranged in a row and column system, so it's easy to key in your moves.

At any stage of the game you can request the computer to suggest a move, reverse roles or change the level of skill.

Full-colour high-resolution graphics.

Planetoids



Dodge and swerve using your thrust button, turn on a planetoid... fire! But beware – the alien ship moves fast to destroy you with cluster bombs. And when it comes to the crunch, use your hyperspace button!

Full-colour high-resolution graphics with sound.

Hungry Horace



Horace is forever being chased around the park by guards.

He steals their lunch, eats pathway flowers and creates chaos in the park by ringing the alarm!

You'll have to be quick to keep Horace out of trouble!

Full-colour high-resolution graphics with sound.

New! Tranz Am



Set in a future time ruled by cars and trophies, in a land where petrol replaces gold, and status is possession of the 8 Great Cups of Ultimate.

Driving your Super Blown Red Racer, use your skill to outwit and crash the Deadly Black Turbos. Use your instruments to locate and collect the trophies – before you overheat or run out of *fuel*.

A program with outstanding multi-directional movement, graphic features, and a playing area equivalent to more than 600 times actual screen area.

Horace and the Spiders



Guide Horace on the hazardous journey to the cobwebbed house full of poisonous spiders.

Safely in the house, you must move along cobwebs, choose a spot... and jump on it! The spiders will be in a frenzy – scuttling to repair their precious web.

And when a spider is spinning a new section, you're safe to attack and destroy it!

Kill all the spiders, and a new web appears... with even more spiders to catch.

Full-colour high-resolution graphics.

New! Cookie



You're Charlie the Chef, who keeps his ingredients locked in the larder. But if the ingredients escape, they bring the inedible Nasties with them!

You must daze the escaping ingredients with flour bombs, and knock them into the mixing bowl. Stop them getting into the dustbin, at all costs! And beware of Nasties that get into the mixing bowl!

Cookie is fast-moving panic in the pantry, with a cast of real characters. A program to make you smile – and sweat!

New! Jet Pac



As Chief Test Pilot of the Acme Interstellar Transport Company, your task is to deliver and assemble spaceship kits. On your way round the galaxy, you're free to collect precious stones and gold.

The catch? Rocket fuel is precious and scarce. And the aliens don't take kindly to the theft of their valuables. You'll need your wits and your lasers!

With a host of features, including multi-directional movement, explosions, sound effects and one and two player option.

ZX MICRODRIVE





NOW ON RELEASE

The ZX Microdrive® System – as you'd expect from Sinclair – is unique to the world of computing. It's a compact, expandable add-on system which provides high-speed access to massive data storage. With just one Microdrive alone (and Interface 1), you'll have at least 85K bytes of storage, the ability to LOAD and SAVE in mere seconds, the beginnings of a local area network of up to 64 Spectrums, *and* a built-in RS232 interface! The cost? Less than £50 for each Microdrive.

How to get ZX Microdrive

Spectrum owners who bought direct from us, by mail order, have been sent full details. Order forms are being mailed in strict rotation, so if you haven't yet received your order form please bear with us. We're making good progress in meeting the huge demand.

If you didn't buy your Spectrum by mail order, don't worry. Send us the form from the bottom of this page. We'll add your name to the mailing list, and send you details by return.

Each Microdrive costs £49.95. Interface 1 costs £49.95, but just £29.95 if purchased with a ZX Microdrive. Extra ZX Microdrive cartridges: £4.95.

How to order

Simply fill in the relevant sections on the order form below. Note that there is no postage or packing to pay on some purchases. Orders may be sent FREEPOST (no stamp needed). Credit card holders may order by phone, calling 01-200 0200, 24 hours a day. 14-day money-back option, of course. Please allow 28 days for delivery.

®ZX, ZX Spectrum, ZX Interface and ZX Microdrive are all registered trade marks of Sinclair Research Ltd.

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Sinclair Research Ltd, Stanhope Road, Camberley, Surrey, GU15 3PS. Telephone: (0276) 685311.

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR. **ORDER FORM**

Section A: Hardware

Qty	Item	Code	Item Price £	Total £
	ZX Interface 2	8501	19.95	
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: Software **ROM CARTRIDGE PROGRAMS**

G12/R	Planetoids	5302	14.95
G9/R	Space Raiders	5300	14.95
G13/R	Hungry Horace	5303	14.95
G24/R	Horace and the Spiders	5305	14.95
G28/R	PSSST	5307	14.95
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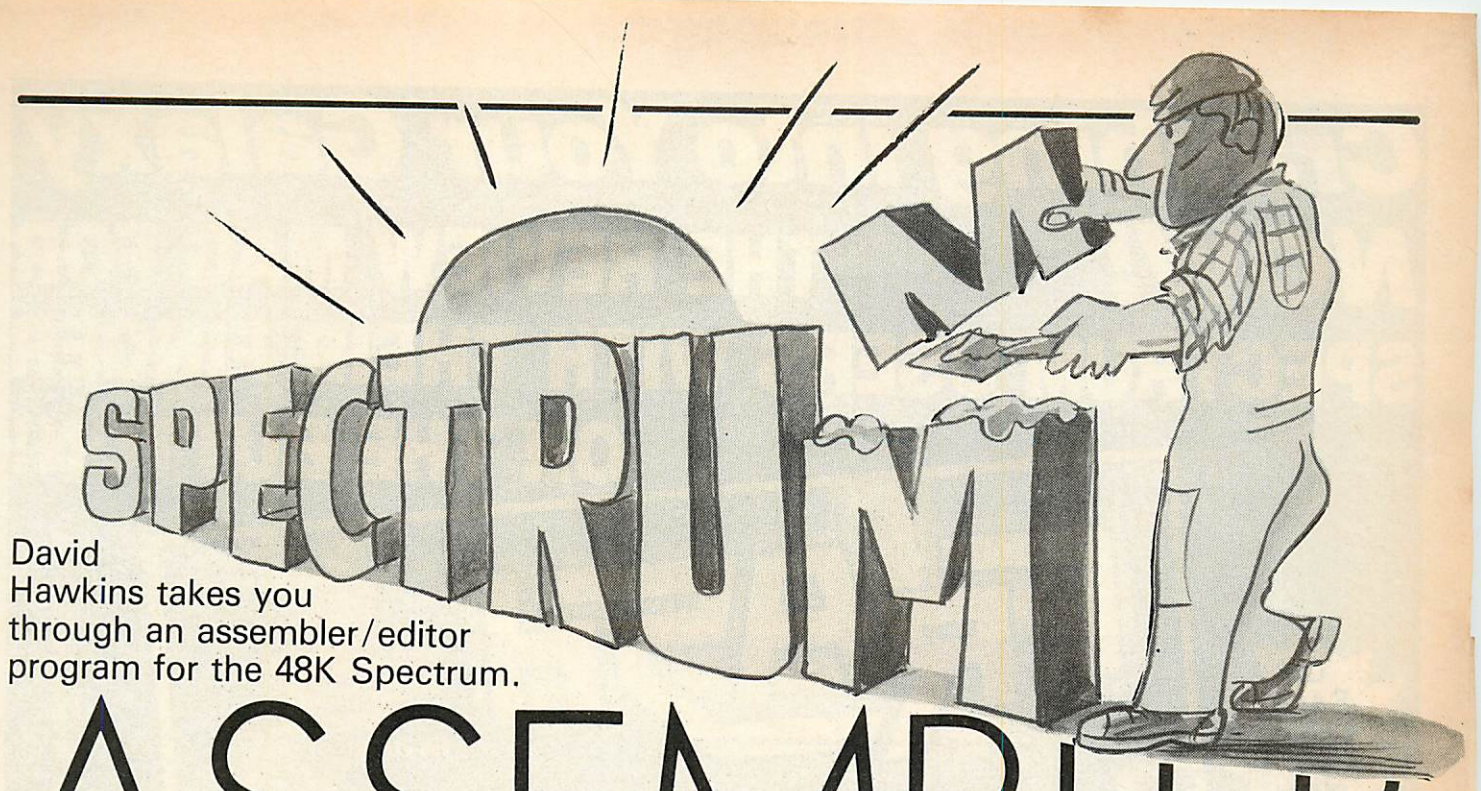
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David Hawkins takes you through an assembler/editor program for the 48K Spectrum.

ASSEMBLER

THE LINES OF Z-80 instructions are held in a Text File, variable q$, which can be any preset size up to about 16K bytes. Each line is held as part of a record which contains all symbolics and semi-assembled code in the following format:

Label no. (line)	1 byte
Opcode	4 bytes
Argument length	1 byte
Code length	1 byte
Label no. (argument)	1 byte
Arguments	as required
Code	as required

The program first sets the size of the file to 2000 bytes.

Control options

Edit	—	enter Editor to view/change the Text File.
Restart	—	restart system, deleting Text File and reprompting for new File size and default Code Start address.
Assemble	—	start assembly of instructions into machine-code, prompting for screen/printer output, Byte/Nobyte values and assembly address.
Code	—	enter machine-code section to Run or Save code.

Editor options

Append	—	add new lines after the last one and assign line numbers. Used to start a new file.
Insert	—	place new lines before a specified line and renumber all following lines. Pass to Print routine.
Delete	—	delete a range of lines and renumber. Pass to Print routine.
Replace	—	delete a range of lines and insert any number of new lines. Pass to Print routine.
Print	—	print symbolic text to the screen with line numbers — if more than 22 lines then start line is asked for. Pressing the Space key will stop the listing.
Load	—	load a previously Saved Text File from tape back into memory, deleting any current File. Pass to the Control menu.
Save	—	save the current Text File to tape — with verification.
Control	—	pass to the Control menu.

The append, insert and replace options require one or more instruction lines to be entered. These lines consist of up to four fields — an optional label, a mandatory opcode and, if required, or or two arguments. These fields are headed by the prompts, Label, Opcode, 1st and 2nd respectively. Each field is terminated using the Enter key which also acts as a tab key. An empty opcode field signals a return to the editor menu. To enter the instruction line L1 LD A , B the key ins required would be L1 ENTER LD ENTER A ENTER B ENTER. No commas are required between arguments.

The system offers a choice of output to screen or printer, then a choice of bytes, byte values shown in assembly listing, or nobytes. The text string following the Text pseudo-op will not have its byte values listed.

The prompt

Origin at NNNNN — Assemble at ?

is then offered where NNNNN is the Code Start address displayed/reset at the Control menu. The default Code Start can be selected by pressing Enter, otherwise an alternative address can be entered. If the latter is chosen, assembly will still be carried out at the code start address but label addresses will be calculated for the alternative address, thus code can be assembled for loading back into an address currently occupied by the assembler program.

The first pass of assembly determines the label addresses, real or virtual, and the second pass calculates and substitutes label values and generates the machine-code. The assembly is followed by a print of final label values.

If the assembled code was relocated as described above it cannot be run by the code menu for obvious reasons if labels are involved. However it is possible to physically assemble the code elsewhere in RAM such as into a Rem statement by using the Defs pseudo-op to shift the actual assembly address up or down in memory.

Errors in assembly will result in a report of the line number at fault and then a return to the editor menu.

(continued on page 161)

FEATURES

- Editor — enabling insertion, deletion and replacement of text lines held in a text file, with auto line-numbering and syntax checking on line entry.
- Saving and Loading of text files.
- Symbolic representation of locations as labels as well as the standard Zilog operation codes and arguments.
- Automatic assembly of forward and backward references to labels, with physical/virtual location of code.
- Comment lines.
- Immediate values represented as decimal numbers, binary numbers, ASCII characters or labels, as required.
- Pseudo operations that insert text strings into the code assembly or that define location addresses, location contents and memory steps by means of numeric expressions.
- Partial assembly of machine-code on entry — making for fast Basic assembly — two lines per second.
- All file input/output in Basic — easily converted for Microdrive operation.
- Easily customised to incorporate new pseudo operations or renamed instructions.
- Assembly listing to screen or ZX Printer with or without byte values of machine-code for Data statements.

the text. The pseudo-ops available are: Rem which enables comments input as the argument and not exceeding 254 bytes to be placed in the program.

Text enables a text string input as the argument and not exceeding 254 bytes to be inserted at the current position during the assembly process.

```
TEXT  message1
TEXT  ABC?-57
```

The following Define opcodes all have a single argument, which must be a numerical expression. Labels may be used within these expressions and are represented not as L1, L2 and so on, but in their Basic subscript form L(1), L(2). The variable Org is also permitted and holds the current assembly address. Defs, Define Shift — shifts the current assembly address by the number of bytes that the

```
   ENTER LD    ENTER B  ENTER 128 ENTER
L1 ENTER LD    ENTER A  ENTER "* ENTER
   ENTER RST   ENTER 16 ENTER
   ENTER DJNZ ENTER L1 ENTER
   ENTER RET   ENTER    ENTER
```

Each line will appear on the upper screen with its appropriate line number. Note that although no argument is required for the Ret opcode the prompt "1st" will still appear — this is because the editor function "read mind" has not yet been implemented and "Ret NZ" or "Ret PO" are just as valid as "Ret" — so just press Enter. At the next "Label Opcode" prompt tab to "Opcode" and tab again to exit from line-input mode. Enter P to print the file. Try deleting the first line, Rem, by using the D options and answering 1 to both From and To. The file will be renumbered and reprinted. Return to the

800	Reset code start and file size.
801-806	Set variables, addresses and line numbers.
Menus	
700-745	Edit
750-770	Code
780-793	Control
795-797	Assembly options
Edit	
10	"Find" routine
20-28	Insert/Replace
30-34	Print
40-45	Delete/Replace
50-52	Append
Line-input	
80-94	Error handling
100-103	Labels
104-110	Opcode. Apply weights to opcode characters to determine line no of appropriate

(continued on page 164)

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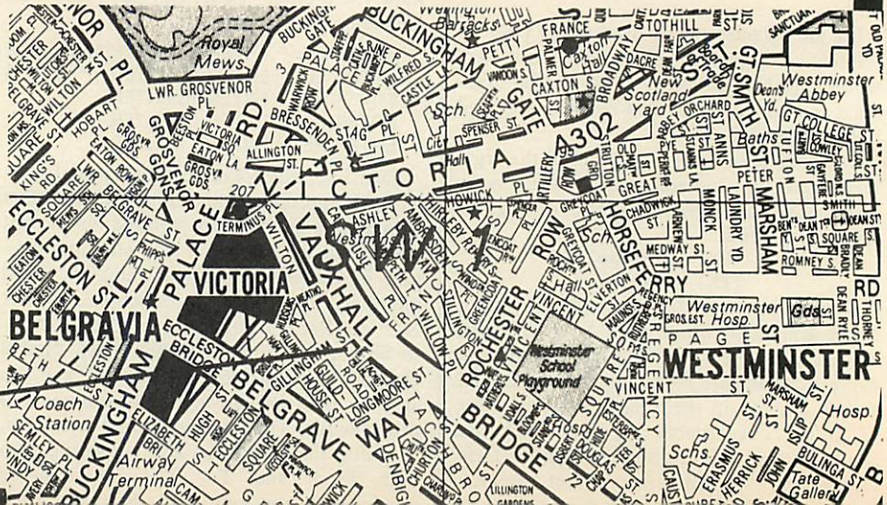
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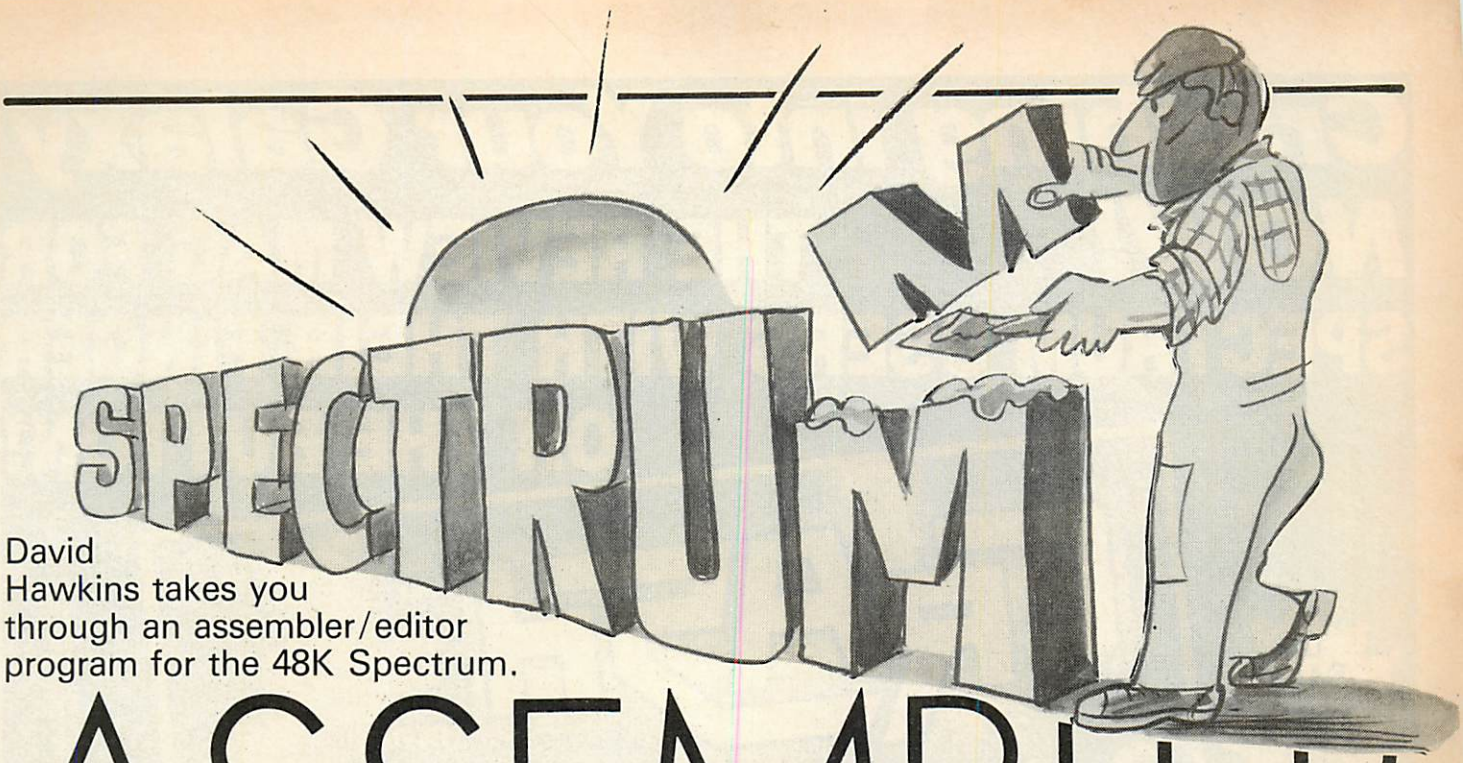
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ASSEMBLER

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Arguments	as required
Code	as required

The program first sets the size of the file to 2000 bytes.

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Edit — enter Editor to view/change the Text File.

Restart — restart system, deleting Text File and reprompting for new File size and default Code Start address.

Assemble — start assembly of instructions into machine-code, prompting for screen/printer output, Byte/Nobyte values and assembly address.

Code — enter machine-code section to Run or Save code.

Editor options

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Insert — place new lines before a specified line and renumber all following lines. Pass to Print routine.

Delete — delete a range of lines and renumber. Pass to Print routine.

Replace — delete a range of lines and insert any number of new lines. Pass to Print routine.

Print — print symbolic text to the screen with line numbers — if more than 22 lines then start line is asked for. Pressing the Space key will stop the listing.

Load — load a previously Saved Text File from tape back into memory, deleting any current File. Pass to the Control menu.

Save — save the current Text File to tape — with verification.

Control — pass to the Control menu.

The append, insert and replace options require one or more instruction lines to be entered. These lines consist of up to four fields — an optional label, a mandatory opcode and, if required, or or two arguments. These fields are headed by the prompts, Label, Opcode, 1st and 2nd respectively. Each field is terminated using the Enter key which also acts as a tab key. An empty opcode field signals a return to the editor menu. To enter the instruction line L1 LD A , B the key ins required would be L1 ENTER LD ENTER A ENTER B ENTER. No commas are required between arguments.

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is then offered where NNNNN is the Code Start address displayed/reset at the Control menu. The default Code Start can be selected by pressing Enter, otherwise an alternative address can be entered. If the latter is chosen, assembly will still be carried out at the code start address but label addresses will be calculated for the alternative address, thus code can be assembled for loading back into an address currently occupied by the assembler program.

The first pass of assembly determines the label addresses, real or virtual, and the second pass calculates and substitutes label values and generates the machine-code. The assembly is followed by a print of final label values.

If the assembled code was relocated as described above it cannot be run by the code menu for obvious reasons if labels are involved. However it is possible to physically assemble the code elsewhere in RAM such as into a Rem statement by using the Defs pseudo-op to shift the actual assembly address up or down in memory.

Errors in assembly will result in a report of the line number at fault and then a return to the editor menu.

(continued on page 161)

FEATURES

- Editor — enabling insertion, deletion and replacement of text lines held in a text file, with auto line-numbering and syntax checking on line entry.
- Saving and Loading of text files.
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- Assembly listing to screen or ZX Printer with or without byte values of machine-code for Data statements.

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(continued from page 159)

Code options

Run — prompt for entry address — default = Code Start address — clear screen and run the current machine-code — if number of bytes of assembled code is non-zero.
Save — Save code to tape.
Edit — pass to editor menu.
Control — pass to control menu.

Syntax checks are made by the editor on entry of each line. If any errors are trapped the line is displayed with the offending field being flashed. Pressing Enter will cause the system to resume at a recovery point, normally line input or a menu. Some errors — such as unpaired brackets — will cause the program to halt with a Basic error such as Variable not found or nonsense in Basic. Entering Goto Help at such times will restart the system at an appropriate recovery point. This Goto Help recovery is available following any break in the program, accidental or otherwise.

As well as the standard Z-80 mnemonics the following symbols are also supported. Labels may be used to represent location addresses or values. The labels permitted are L1 through to L99 and can appear as Line identifiers or arguments. When used as arguments they must be stand-alone except after pseudo-ops, see below, where expressions may be used.

```
      LD    B,12
L1    DJNZ  L1
      JP    L90
```

Values can be specified in the most convenient way, decimal, binary, character or label. Decimals can be positive or negative and are represented by a number or numeric expression.

```
LD  A,-3
LD  BC,256*5+3
LD  HL,(3395)
```

Binary numbers are represented using the BIN function prefix.

```
AND  BIN 111
CP   BIN 1100
LD   DE,BIN 111111000000
```

Characters are prefixed with a quote and can be any character that the Spectrum provides — including keyword tokens.

```
LD   BC,"+-"
CP   "a
SUB  "0"
```

A trailing quote may be used but is not necessary.

Pseudo opcodes can be used at any point in the text. The pseudo-ops available are: Rem which enables comments input as the argument and not exceeding 254 bytes to be placed in the program.

Text enables a text string input as the argument and not exceeding 254 bytes to be inserted at the current position during the assembly process.

```
TEXT  message1
TEXT  ABC?-57
```

The following Define opcodes all have a single argument, which must be a numerical expression. Labels may be used within these expressions and are represented not as L1, L2 and so on, but in their Basic subscript form L(1), L(2). The variable Org is also permitted and holds the current assembly address. Defs, Define Shift — shifts the current assembly address by the number of bytes that the expression evaluates to, positive or negative.

```
    REM  move the assembly address to 61000
    DEFS 61000-ORG
    REM  Reserve 20 bytes at address L99
L99 DEFS 20
```

DefL, define label, equates a label to the evaluated expression.

```
L1  TEXT text message
L2  DEFL L(2)-L(1)
    REM  L2 now contains the message length
L20 LD   BC,L2
    REM  BC loaded with message length
```

DefB, define byte, evaluates the expression to modulus 256 and places the value in the byte at the current assembly address.

```
    REM  Calculate length of text string
L90 DEFB L(91)-L(90)-1
    TEXT ABCDEFGH
L91 REM  L90 now points to the byte count
         before the text string.
```

DefW, define word, is the same as DefB but the value is placed in two bytes and is to modulus 65536. Label address/values are determined on the first pass of assembly, calculations are carried out on the second pass except DefS — it alone evaluates on the first pass and only preceeding labels will have been set.

We shall enter and assemble a machine-code program that will print asterisks on the first four lines of the screen. The mnemonics for the program are:

```
      LD    B,128
L1    LD    A,"*
      RST   16
      DJNZ  L1
      RET
```

Starting at the control menu, enter R to reset the file size, answering "File length" with 1000 and "Code start" with 56000, resetting RAMtop to 55999. Enter E to pass to the editor. At the editor menu, as the file is empty, enter A to append. The line-input prompt "Label Opcode" will appear on the lower screen so, as no label is required for the first line, tab to the opcode field using the Enter key. Type Rem and press Enter. The prompt "1st" for first argument appears and you can type in the comment "Trial run" removing Caps lock if you wish — it will be automatically reset upon entry, and then press Enter. The opcode Rem only expects one argument so it will not ask for another. The line will be printed on the upper screen with a line number of 1 and the lower screen will again show the prompt "Label Opcode". Enter the remaining lines as follows:

```
   ENTER LD    ENTER B  ENTER 128 ENTER
L1 ENTER LD    ENTER A  ENTER "* ENTER
   ENTER RST   ENTER 16 ENTER
   ENTER DJNZ ENTER L1 ENTER
   ENTER RET   ENTER    ENTER
```

Each line will appear on the upper screen with its appropriate line number. Note that although no argument is required for the Ret opcode the prompt "1st" will still appear — this is because the editor function "read mind" has not yet been implemented and "Ret NZ" or "Ret PO" are just as valid as "Ret" — so just press Enter. At the next "Label Opcode" prompt tab to "Opcode" and tab again to exit from line-input mode. Enter P to print the file. Try deleting the first line, Rem, by using the D options and answering 1 to both From and To. The file will be renumbered and reprinted. Return to the control menu using the C option to see how much space has been used and how much remains.

Save the file to tape by returning to the edit menu and using the S option. The program will verify the file after Saving. To see how easy it is to load a text file back into the system, use the Control option R to clear the file and reset to a different size, Code Start still set to 56000, then return to edit and load the file back in. The control screen will then describe the loaded file characteristics.

Let us now try assembling the machine code — go to the control menu and select the A option. At the Screen or Printer prompt type S to direct output to the screen, unless you have a ZX printer attached and feel adventurous. Answer the "Bytes or Nobytes" prompt with B to print byte values. The system will then state that assembly will be carried out at address 56000 and give you the opportunity to over-ride that with the prompt "Origin at ?".

To take the default of 56000 just press Enter and assembly will commence. Press the Space key to pause the display during assembly.

To run the code use the R option at the code menu. The system will remind you that the origin is at 56000 and it will ask for an entry address — take the default by pressing Enter. The machine-code will then obediently fill the top four lines of the screen with asterisks. Now return to the edit menu and try something else.

Program sections

Save Program
9999 — Save and Verify the Basic Assembler/Editor program.

Run start
1 — Set Run defaults.

Functions
2 — r — Range check
3 — a — Address
4 — q$ — File slice
5 — c — File byte value

"Insert" routine
2000-2006 — Machine code loader for record-insert routine. The code is loaded into a Rem statement whose address is in variable "insert". The code is relocatable so the Rem could be anywhere in the program. When the program has been run and the machine code proven to be correct then lines 2004 and 2006 can be deleted.

Initialize
800 — Reset code start and file size.
801-806 — Set variables, addresses and line numbers.

Menus
700-745 — Edit
750-770 — Code
780-793 — Control
795-797 — Assembly options

Edit
10 — "Find" routine
20-28 — Insert/Replace
30-34 — Print
40-45 — Delete/Replace
50-52 — Append

Line-input
80-94 — Error handling
100-103 — Labels
104-110 — Opcode. Apply weights to opcode characters to determine line no of appropriate

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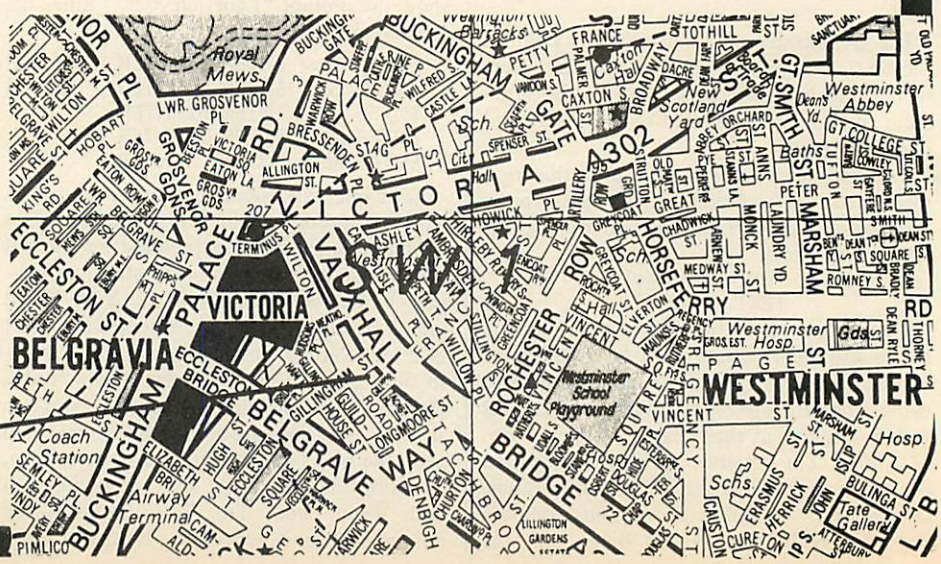
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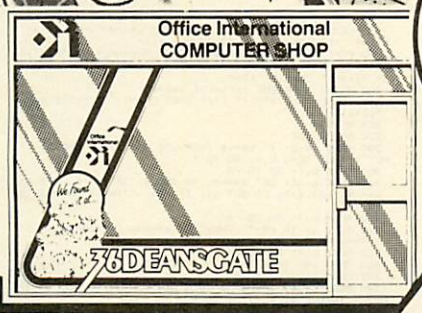


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		syntax packets.
112-116		Argument input
120	(rd)	Syntax checking
125-130	(op)	Set up Text File record

Following each opcode and maximum number of arguments are one or more packets. These packets are additional Data items which vary according to the number of arguments as follows: If args = 0 then follows an instruction byte value and an output format type. If args > 0 then the input line being examined is assumed to have one of a series of possible syntax properties. These properties are defined by "packets" consisting of a packet type, address of packet handler; packet parameters, argument-checking addresses; instruction byte value; and output format type. If a line does not satisfy any packet for an opcode, an error is signalled via the "nn" packet handling address.

812-817		"LD" opcode packets — classified by length of first argument
821-1632		Remaining packets
Packet handler		
300	(sv)	Literal and variable
310	(vv)	Variable and variable
320	(vn)	Variable only
330	(ss)	Literal and literal
340	(vs)	Variable and literal
350	(load)	Classify "LD" choices by length of first argument
360	(ldr)	Register to register LD (check (HL),(HL))
370-390	(ps)	Pseudo ops
395	(nn)	Syntax packet not found
Argument syntax checking		
400	(ri)	Registers and indirect HL/ Index registers
410	(vl)	Single byte direct values
420	(da)	BC, DE & AF registers
430	(ds)	BC, DE & SP registers
440	(di)	HL & Index registers
450	(dd)	Double registers
460	(cf)	Conditions (JP, CALL)
470	(v2)	Double byte direct values
480	(ra)	RST addresses
490	(bn)	BIT numbers
500	(im)	Interrupt mode
510	(cs)	Condition subset (JR)
520	(bv)	Double byte indirect values
530	(bv1)	Single byte indirect values
Output code formatting		
600	(f0)	237 Instr n1 n2
602	(f1)	[Index] Instr
604	(f2)	[Index] Instr [Offset]
606	(f3)	[Index] 203 [Offset] Instr
608	(f4)	[Index] Instr n1 n2
610	(f5)	Instr n
612	(f6)	Instr 0 (for jump offset)
614	(f7)	237 Instr
616	(f8)	[Index] Instr [Offset] n
Assemble		
200-210		Set origin (ORG) and make first pass (Labels)
220-255		Second pass (place machine code)
260-270		Print Label values

A Text File can be increased in size without deleting its contents, as follows:

```
Save the File to tape
Use NEW command to clear memory
LOAD "" DATA z$()
DIM q$(new size)
LET q$( TO LEN z$ ) = z$
SAVE "Textfile" DATA q$()
```

Conversion to Microdrive: The Basic program will move up the memory map by at least 500 bytes with a Microdrive attached; however the machine-code routine "insert" will not be affected as it is relocatable. The only changes needed will be to those lines where Save, Load and Verify are used. They are:

```
737  Save and verify Text File ( q$ )
740  Load Text File ( q$ )
760  Save machine code
9999 Save and verify program
```

The system as written allows for up to 99 labels — L1 to L99. Two other special label numbers are also used internally — 0 indicates the absence of a Label and 255 (hi) indicates a pseudo-op that requires calculation. With this in mind, the label range could be extended to L1 to L254, if required, by amending lines 103 (range check), 204 (DIM) and 261 (print values).

The packet line number for a new opcode is calculated by multiplying the ASCII codes for each of the four characters — trailing spaces if necessary — by the weights 2, 5, 6 and 4 respectively, and adding the products. If the result is a line number that is not in use then the opcode can be added to the system. Note: when the system indicates an opcode error the variable "a" contains the calculated line number so, to determine the required line number, enter the proposed opcode via Line-input then Break and Print a.

One extra pseudo-op is already present, "TRA" — for Trace — at line 1096. The handler is directed to line "op" which results in no machine code being allocated to the record. If "k1,op" on line 1096 is replaced by "k0,k0,ps+10", line 380 inserted to read "LET m$ = k$" and k$ initialised to contain a machine-code tracing routine — halt and display registers then continue or exit — then using the opcode "TRA" would cause the machine-code routine to be merged into the main code at that point.

As well as adding new opcodes or replacing old ones — such as replacing "RST 16" with "PRNT" — parts of the program could be replaced by machine code. The insert routine was developed on an earlier version of the program which used a slow Basic loop — slicing of a large Text File becomes impossible beyond a certain size — to insert new records into the Text File.

Possible areas for improvements in speed and size are:

```
Find line          — line 10
Syntax checking — lines 400-531
```

Maybe you would just prefer to assemble your own machine-code Editor/Assembler!

Many of the program lines are specifically numbered so please ensure that all line numbers are entered as printed. Debugging of the program can be simplified by entering the program a section at a time, in the order indicated in the program sections, and by not entering all of the packets at once, but by starting with a few simple opcodes like "LDDR" and "SCF".

Should the task of keying-in the whole program prove too daunting, a small number of tape copies of the program can be obtained for £3 each from the author at: 43 Frome Road, Trowbridge, Wilts. BA14 0DQ.

```
  Note: for £ read hash character
   1 CLEAR 54999: LET a=2000: GO TO 801
   2 DEF FN r(x,y,z$)=(CODE z$>=CODE STR$ x) AND (CODE
z$<=CODE STR$ y)
   3 DEF FN a(x)=PEEK x+256*PEEK (x+1)
   4 DEF FN q$(x,y)=q$(ptr+x TO ptr+y)
   5 DEF FN c(x)=CODE q$(ptr+x)
  10 FOR x=k1 TO 1-k1: LET a=a+FN c(6): LET ptr=ptr+8+
FN c(5)+FN c(6): NEXT x: RETURN
  20 IF l1>lns OR l1<k1 THEN LET z$="Range error": GO
TO 700
  22 PRINT BRIGHT k1;"Inserting": LET l=l1: LET ptr=9:
 GO SUB 10
  24 GO SUB 100: LET l=l+k1: LET len=LEN p$: IF NOT le
n THEN GO TO 28
  25 IF last+len>LEN q$ THEN LET z$="No more room": GO
 TO run
  26 RANDOMIZE last-ptr+k1: LET q$(ptr TO ptr+len-k1)=
p$ AND USR insert: LET ptr=ptr+LEN p$: LET mc=mc+LEN m
$: LET last=last+len: LET lns=lns+k1: GO TO 24
  28 LET l1=l-10: LET l2=lns: IF l1>lns-32 THEN LET l1
=lns-21
  29 IF l1<=k0 OR lns<=22 THEN LET l1=k1
  30 PAUSE k1: LET ptr=9: LET l=l1: GO SUB 10: CLS : I
F NOT lns THEN PRINT "Empty": GO TO 701
  32 POKE scc,hi: LET l=FN c(k0): LET l$=("L"+STR$ l)
AND l: PRINT l1;TAB 3;l$;TAB 8;FN q$(k1,4);TAB 13;: LE
T l=FN c(5): PRINT FN q$(8,7+l): LET ptr=ptr+8+l+FN c(
6): LET l1=l1+k1: IF l1<=12 AND INKEY$="" THEN GO TO 3
2
  34 GO TO 701
  40 IF l1<k1 OR l2>lns OR l1>12 THEN LET z$="Range er
ror": GO TO run
  42 LET l=l1: LET ptr=9: GO SUB 10: LET p1=ptr: LET l
=12-l1+2: LET a=k0: GO SUB 10: LET len=ptr-p1
  44 FOR x=p1 TO last-len-31 STEP 32: LET y=x+len: LET
 q$(x TO x+31)=q$(y TO y+31): NEXT x: LET q$(x TO last
-len)=q$(x+len TO last): LET mc=mc-a: LET last=last-le
n: LET lns=lns-12+l1-k1: LET len=k0: IF z$<>"R" THEN G
O TO 28
  45 PRINT "Replacing ";l1;" to ";l2: LET ptr=p1: LET
l=l1: IF ptr<last THEN GO TO 24
  50 LET l=lns+k1: GO SUB 100: LET len=LEN p$: IF NOT
len THEN GO TO 701
  51 IF last+len>LEN q$ THEN LET z$="No more room": GO
 TO run
  52 LET q$(last+k1 TO last+len)=p$: LET mc=mc+LEN m$:
 LET last=last+len: LET lns=lns+k1: GO TO 50
  80 BEEP .1,k0: POKE 23658,8: INPUT "Error" FLASH (x
=1);(l#);TAB 7; FLASH (x=2);(a#);TAB 14; FLASH (x>2);(
b#);" ";(c#); FLASH k0;TAB 30; LINE z#: RETURN
  90 IF x=3 THEN RETURN
  94 GO SUB 80: IF x>k1 THEN GO TO 104
 100 LET m$="": LET x=k1: INPUT (d$)' LINE l#: IF l#="
" THEN LET l1=k0: GO TO 104
 102 IF CODE l#<>CODE "L" OR NOT FN r(k0,9,l#(2 TO ))
THEN GO TO error
 103 LET l1=VAL l#(2 TO ): IF STR$ l1<>l#(2 TO ) OR AB
S (l1-50)>49 THEN GO TO error
 104 LET b$="": LET c$="": LET len=k0: LET x=2: INPUT
(d$)'(l#);TAB 7; LINE a$
 106 IF a$="" THEN LET p$="": RETURN
 110 LET a$=a$: LET a=2*CODE a$+5*CODE a$(2)+6*CODE a$
(3)+4*CODE a$(4): RESTORE a: READ t$: IF t$<>a$ THEN G
O TO error
 112 LET d=k0: LET n=k0: LET l2=k0: LET i=k0: READ a:
IF NOT a THEN READ b,f: GO TO f
 114 INPUT (d$)" ist"(l#);TAB 7;(a#);TAB 14; LINE b$
 115 IF a>k1 THEN INPUT (d$);TAB 15+LEN b$;"2nd"'(l#);
TAB 7;(a#);TAB 14;(b#);" "; LINE c#
 116 LET a=(b$<>"")+(c$<>"")
 120 LET x=3: LET i=k0: LET d=k0: LET n=k0: LET l2=k0:
READ g: GO TO g
 125 LET b$=b$+(","+ AND (c$<>""))+c$: PRINT l;TAB 3;l#
;TAB 8;a#;TAB 13;b$
 126 LET p$=CHR$ l1+e$+CHR$ LEN b$+CHR$ LEN m$+CHR$ 12
+b$+m$
 129 POKE 23658,8
 130 RETURN
 200 OPEN £2,s#: LET help=780
 202 INPUT "Assemble at ";(adr);". Origin at ?"; LINE
z#: LET org=adr: IF z#<>"" THEN LET org=VAL z#
 204 LET dif=adr-org: DIM l(99): LET ptr=9: CLS : PRIN
T BRIGHT k1;"1st Pass - Labels"
 205 FOR x=k1 TO lns: LET l=FN c(k0): IF l<>k0 THEN LE
T l(l)=org: POKE scc,hi: PRINT "L";l;TAB 4;" = ";org,"
line ";x
 206 IF FN q$(k1,4)="DEFS" THEN LET org=org+VAL FN q$(
8,7+FN c(5))
 210 LET org=org+FN c(6): LET ptr=ptr+8+FN c(5)+FN c(6
): NEXT x
 220 LET org=adr-dif: LET ptr=9: PRINT ' BRIGHT k1;"2n
d Pass - Assembly"
 223 FOR x=k1 TO lns: LET l$="": PRINT org;: LET a$=FN
 q$(k1,4): LET l=FN c(7): LET l1=FN c(5): LET l2=FN c(
6): LET m$=FN q$(8+l1,7+l1+l2): IF FN c(k0)<>k0 THEN L
ET l$="L"+STR$ FN c(k0)
 224 IF org>65535 THEN LET z$="Address too large - Lin
e "+STR$ x: GO TO run
 225 IF INKEY$<>"" THEN GO TO 225
 226 POKE scc,hi: IF l=hi THEN LET n=VAL FN q$(8,7+FN
c(5)): LET l=k0: LET n2=INT (n/256): LET n1=n-256*n2:
LET n2=n2+256*(n2<k0): IF a$="DEFW" THEN LET m$=CHR$ n
1+CHR$ n2
 227 IF a$="DEFL" THEN LET l(FN c(k0))=n
 228 IF a$="DEFB" THEN LET org=org+n
 229 IF a$="DEFB" THEN LET m$=CHR$ n1
 230 PRINT TAB 6;l#;TAB 11;a#;TAB 16;FN q$(8,7+11);" "
;: LET ptr=ptr+8+l1+12: IF NOT l THEN GO TO 250
 235 LET a=k1: IF l(l)=k0 THEN LET z$="Undefined label
 - Line "+STR$ x: GO TO run
 240 IF l2=2 THEN LET z$="Jump too far": LET f=l(l)-or
g-2: IF f>=-127 AND f<=128 THEN LET a=k0: LET f=256*(f
<k0)+f: LET m$(2)=CHR$ f
 245 IF l2>2 THEN LET z$="Label too large": LET n2=INT
 (l(l)/256): LET n1=l(l)-256*n2: IF n2>=k0 AND n2<=hi
THEN LET a=k0: LET m$(l2-k1)=CHR$ n1: LET m$(l2)=CHR$
n2
 248 IF a THEN LET z#=z#+" - Line "+STR$ x: GO TO run
 250 LET z$="": FOR y=k1 TO 12: IF b$="B" THEN IF a$<>
"TEXT" THEN PRINT TAB 27;CODE m$(y);
 255 POKE org+dif,CODE m$(y): LET org=org+k1: NEXT y:
PRINT : NEXT x: LET len=org-adr+dif: PRINT '"   Origin
 = ";adr;"  Len = ";len
 260 PRINT ' BRIGHT 1;"Label values"
 261 FOR z=1 TO 99: IF l(z) THEN PRINT "L";z;TAB 4;" =
 ";l(z)
 262 NEXT z
 270 GO TO 750
 300 READ v$,g: IF b$=v$ THEN LET s$=c$: GO SUB g: IF
NOT x THEN READ b,f: GO TO f
 302 READ b,f: GO TO rd
 310 READ g,g1: LET s$=b$: GO SUB g: IF NOT x THEN LET
 s$=c$: LET x=3: GO SUB g1: IF NOT x THEN READ b,f: GO
 TO f
 312 READ b,f: GO TO rd
 320 READ g: IF c$="" THEN LET s$=b$: GO SUB g: IF NOT
 x THEN READ b,f: GO TO f
 322 READ b,f: GO TO rd
 330 READ v$: IF (b$+c$)=v$ THEN READ b,f: GO TO f
 332 READ b,f: GO TO rd
 340 READ g,v$: IF c$=v$ THEN LET s$=b$: GO SUB g: IF
NOT x THEN READ b,f: GO TO f
 342 READ b,f: GO TO rd
 350 RESTORE 817+((LEN b$-5) AND (LEN b$<5)): READ s$:
 GO TO rd
 360 READ g,g1: LET s$=b$: GO SUB g: IF NOT x THEN LET
 r1=r: LET s$=c$: LET x=3: GO SUB g1: IF NOT x AND (r1
<>6 OR r<>6) THEN READ b,f: GO TO f
 362 READ b,f: GO TO rd
 370 LET x=4: LET org=VAL b$: LET l2=hi: LET m$="": GO
 TO op
 372 LET x=4: LET n=VAL b$: LET l2=hi: LET m$=" ": GO
TO op
 374 LET x=4: LET n=VAL b$: LET l2=hi: LET m$="  ": GO
 TO op
 376 LET m$=b$: GO TO op
 378 LET x=4: IF l1>k0 AND l1<100 THEN LET n=VAL b$: L
ET l2=hi: LET m$="": GO TO op
 379 LET x=k1: LET z$="No label": GO TO error
 395 LET x=4: GO TO error
 400 LET r=(s$="B")+(2 AND s$="C")+(3 AND s$="D")+(4 A
ND s$="E")+(5 AND s$="H")+(6 AND s$="L")+(7 AND s$="(H
L)")+(8 AND s$="A"): IF r THEN LET r=r-k1: LET x=k0: R
ETURN
 402 IF CODE s$=CODE "(" THEN LET i=221+(s$(2 TO 3)="I
X")+253*(s$(2 TO 3)="IY"): IF i THEN LET r=6: LET d=VA
L s$: IF d>=-128 AND d<=127 THEN LET d=d+256*(d<k0): L
```

(listing continued on page 167)



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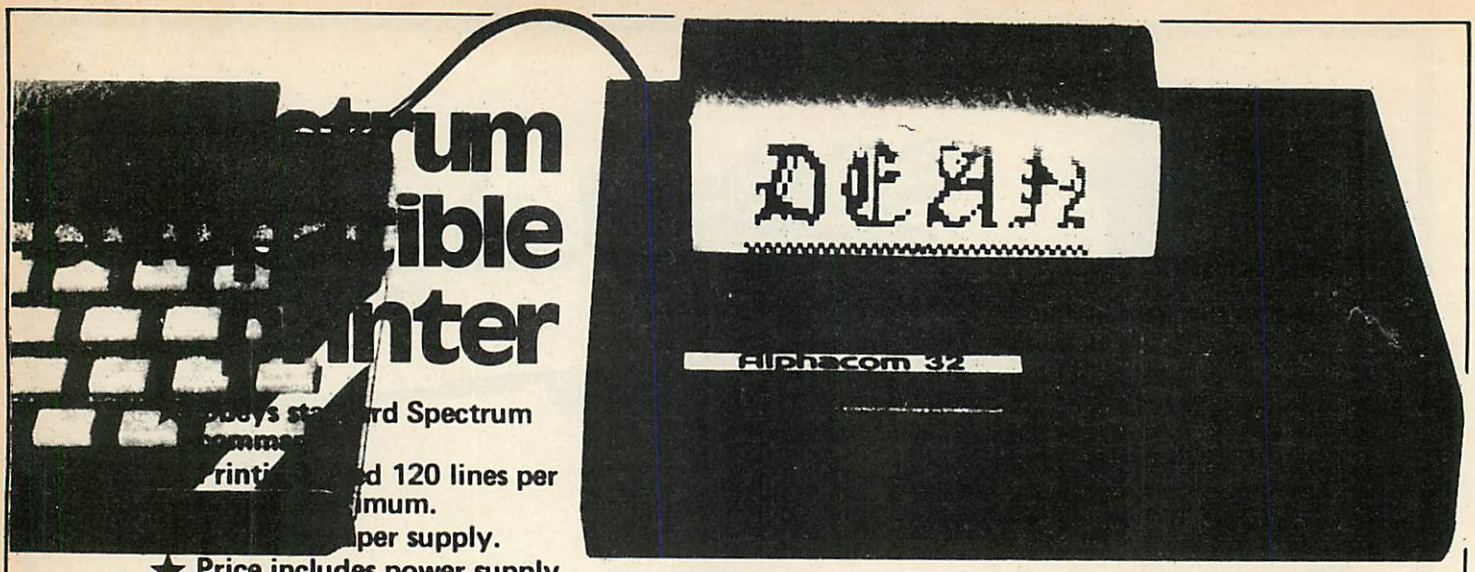
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MERGE

The ability to merge two programs together is a powerful one. Richard Taylor explains how.

ONE OF THE MANY features which are sadly lacking on the ZX-81 is a Merge facility. The program will run in practically any memory size and is written entirely in machine code. On loading, it will automatically relocate itself above RAMtop and is therefore transparent to the user. It will merge any two Basic programs in just a couple of seconds.

The machine code is 287 bytes long and is held, at least initially, in the now usual line 1 Rem statement. This Rem statement should contain at least 287 Xs. Now enter the Basic program in listing 2. Run this in fast mode and carefully enter the code from listing 1. You can enter this either one or several bytes at a time, e.g.,
76. 76. CD. E7. 02. or 7676CDE702. Where "." represents Newline.

The program will stop automatically when all the code has been entered. If the word Error appears on the screen at this point then you have made a mistake in entering the code. You will have to start again in this case.

Now delete the Loader program — not line 1 — and type in listing 3. All this time you may not see the complete program listing on the screen, just "1 Rem" in the top left-hand corner of the screen. Do not worry about this. This is to prevent the machine code in the Rem statement being listed as this can cause the machine to crash.

Now type "RUN". The Save command in line 10 will commit the program to tape under the filename Merge. This is the final Save of the program. When Saved the program will automatically copy itself above RAMtop and New itself — as it will after reloading the program at any time. Type in the following line:
9999 REM THIS LINE WILL BE MERGED INTO ANOTHER PROGRAM.

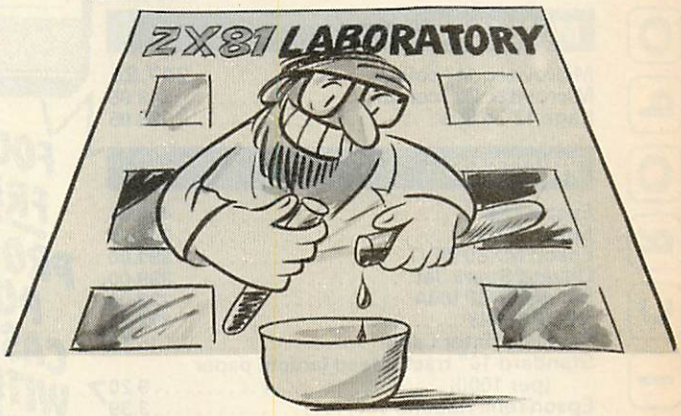
Locate your cassette to the start of a small Basic program which does not contain any machine code or a line numbered 9999. Type:
RAND USR (PEEK 16388+256*PEEK 16389)
and Newline. Now follow the normal procedure for Loading a program. Act as though you had typed LOAD" " instead of the above line. The machine should stop with the '00' report. If it stops with E/0 then follow the above procedure again. If you now List the program you will find that the previously entered line 9999 is in the program.

The ability to merge two programs together is a powerful one. It can greatly speed up program development. For instance, you could keep a set of frequently used subroutines which could be merged into a program in any order. The merge routine only merges the program, not the variables. In fact the merge routine will only load as far as the display file, which is just after the program.

If two lines both have the same number then the old one is kept. The variables are left unchanged. If the program which you are merging in usually auto runs then this will be prevented. There must be no machine code in Rem statements in the two programs which you are trying to merge together.

The merging routine will give report E if it is unable to read in the program because it is unloadable. If may also give error 4 if it is unable to hold both programs in memory at once. The break key has the usual effect.

On initial loading the program automatically reserves the top 226 bytes of RAM — according to RAMtop.
RAND USR (PEEK 16388+256*PEEL 16381)
will call the merge routine. This always acts like LOAD " " i.e., it uses the first program it comes to. ■



Listing 1.

```
16518 - 76 76 CD E7 02 2A 04 40
16530 - 01 E2 00 B7 ED 42 22 04
16538 - 40 E5 01 0C 00 09 22 C7
16546 - 40 22 E6 40 22 F6 40 22
16554 - 00 41 22 19 41 E1 54 5D
16562 - 2B 36 3E 2B F9 2B 2B 22
16570 - 02 40 21 BF 40 01 E2 00
16578 - ED B0 C3 C3 03 CD E7 02
16586 - FD CB 21 86 CD CB 40 16
16594 - FB 0E 01 06 00 3E 7F DB
16602 - FE D3 FF 1F 30 5A 17 17
16610 - 38 67 10 F1 C1 FD CB 21
16618 - 46 20 5A CD CB 40 FD CB
16626 - 21 C6 79 17 30 F5 1E 05
16634 - 21 3C 40 CD CB 40 71 23
16642 - 1D 20 F8 1E 6F CD CB 40
16650 - 1D 20 FA 2A 3F 40 11 7D
16658 - 40 B7 ED 52 C8 EB 2A 10
16666 - 40 01 80 00 09 E5 CD CB
16674 - 40 71 23 ED 4B 02 40 05
16682 - E5 ED 42 E1 30 19 1B 7A
16690 - B3 20 EB 36 80 E1 18 2E
16698 - 3E FF 32 27 40 FD CB 3B
16706 - 86 CF 0C 18 8E CF 0D CF
16714 - 03 D5 1E 94 06 1A 1D DB
16722 - FE 17 CB 7B 7B 38 F5 10
16730 - F5 D1 20 04 FE 56 30 E3
16738 - 3F CB 11 30 DE C9 11 7D
16746 - 40 7E E6 C0 20 31 1A 13
16754 - BE 23 20 02 1A BE 1B 2B
16762 - 30 08 E5 EB CD F2 09 E1
16770 - 18 EC 28 13 D5 CD F2 09
16778 - E3 C5 28 CD 9E 09 23 23
16786 - C1 D1 EB ED B0 18 D2 D5
16794 - CD F2 09 EB D1 18 CA 21
16802 - 00 00 22 29 40 CF FF
```

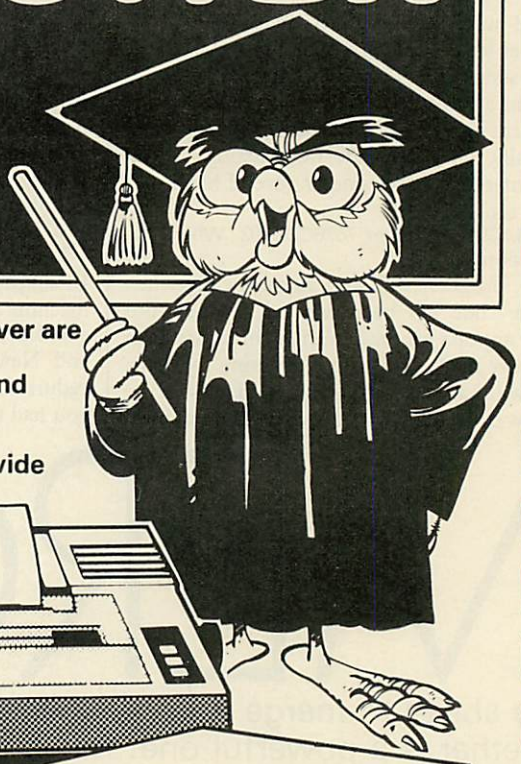
Listing 2.

```
  1 REM (AT LEAST 287 "X" )
 10 LET A=0
 20 LET A$=""
 30 FOR B=16514 TO 16800
 40 IF A$="" THEN INPUT A$
 50 LET C=16*CODE A$+CODE A$(2)
-476
 60 POKE B,C
 70 LET A=A+C
 80 SCROLL
 90 PRINT B;" - ";A$( TO 2)
100 LET A$=A$(3 TO )
110 NEXT B
120 SCROLL
130 IF A<>31510 THEN PRINT "ERR
OR"
```

Listing 3.

```
  1 REM (MACHINE CODE)
10 SAVE "MERGE"
20 RAND USR 16516
```

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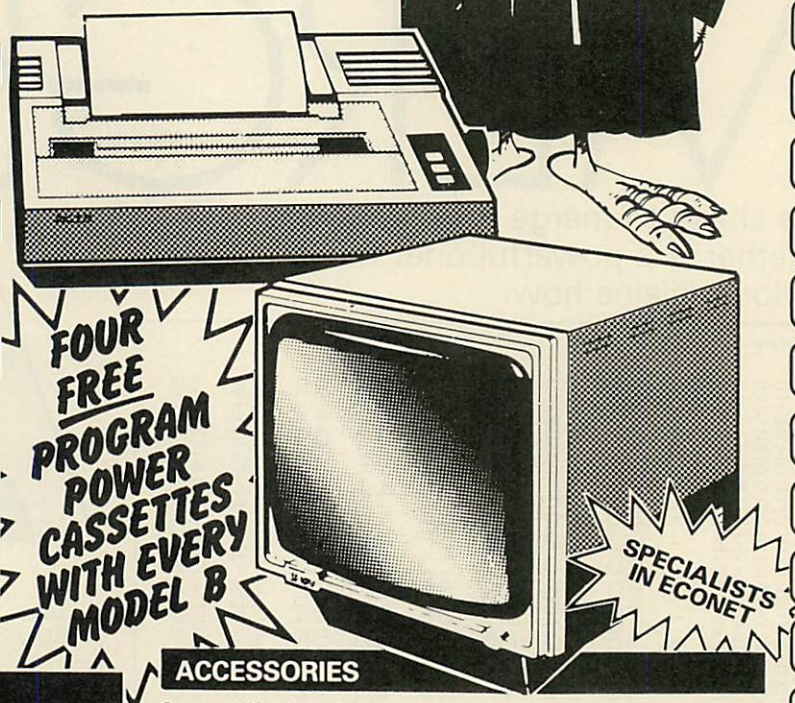
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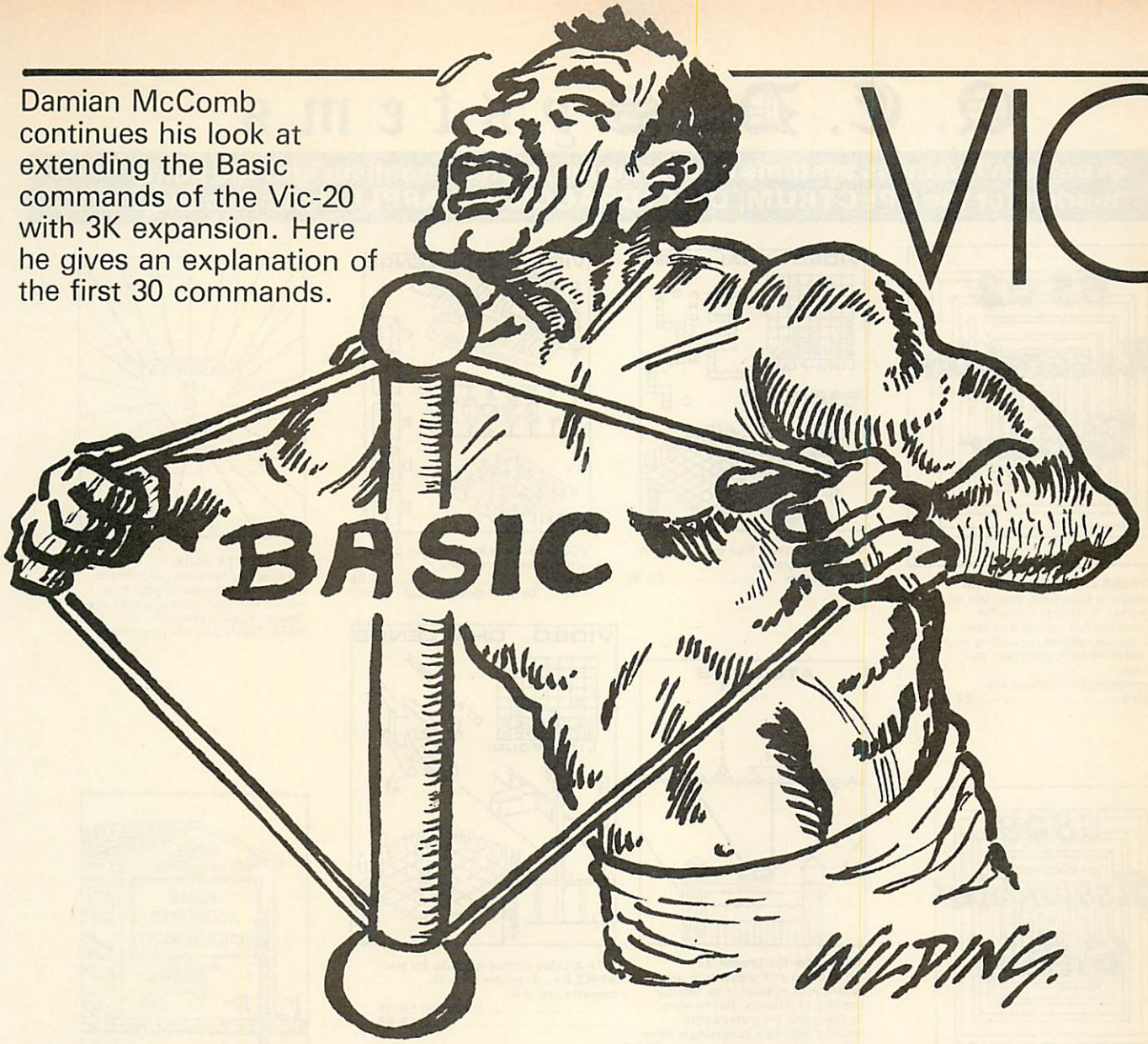
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MICRO POWER - PUT TO THE TEST WE'LL PASS WITH HONOURS!

Damian McComb continues his look at extending the Basic commands of the Vic-20 with 3K expansion. Here he gives an explanation of the first 30 commands.

VIC BASIC EXPANSION



LAST MONTH I EXPLAINED the theory behind extending the Vic-20's interpreter and I gave the first part of a program which adds 42 new commands and functions.

This month, the second of three parts of the program along with a description of the first 30 commands. This list should be cut out or photo-copied and kept as a reference when using your new Basic.

Resume will reset the IRQ vector, which effectively turns off the Beep command.

Fill A,B,C fills a specified area, or areas, of memory with specified values. A is the start and B is the end locations of the fill. C is the fill value.

This can be used to fill the screen or portions of the screen with particular characters or colours e.g.,

```
FILL 7680, 8185, 42, 38400, 38905, 2
```

fills the entire screen in an instant with red stars.

CLS is a very common command which simply clears the screen and sets the cursor position to the top of the screen.

Err is similar to the error command on some versions of Basic and is used to output an error message from the list in the Basic interpreter e.g., ERR 20 gives 'DIVISION BY ZERO ERROR'.

Window positions the visible part of the screen according to its horizontal and vertical parameters, A and B respectively 12 and 38 are the default values.

Sound is almost identical to the one on the BBC Micro. It is used to play a note or number of notes at a specified pitch, volume and duration.

A is the voice number (0-3, 3 = white noise)
B is the volume (0-15)
C is the pitch (128-255)
D is the duration (1-65535), about 150-1 sec.

Two or more notes can be played in one statement by simply putting four more parameters for each note, for instance, try this:

```
SOUND 1,15,200,70,1,15,206,70,1,15,194,70,0,
      15,194,70,0,15,214,70
```

Music can be used for playing chords since it allows you to have all sound registers on at once.

A-C	= voices 0-2	range 128-255
D	= white noise	
E	= volume	range 0-15

Ink is the same as on the Spectrum and Oric and it selects the colour of characters printed to the screen. However, it also allows you to enter multi-colour code.

0-7 = ordinary colours.
8-15 = multicolour choices.

Paper is also a command on other popular micros and it simply changes the screen foreground colour to one of 16 colours.

0 = Black.	5 = Green.
1 = White.	6 = Blue.
2 = Red.	7 = Yellow.
3 = Cyan.	8 = Orange.
4 = Purple.	9 = Light orange.

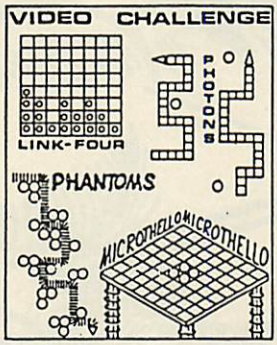
(continued on page 173)

Q. E. D. Systems

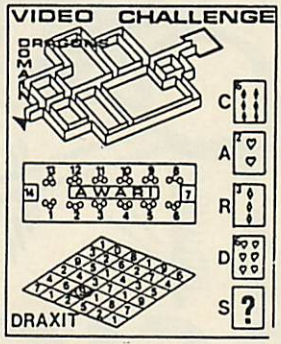
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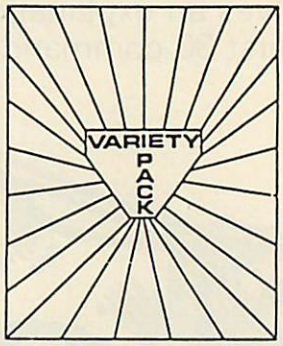
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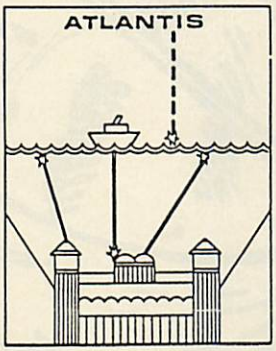
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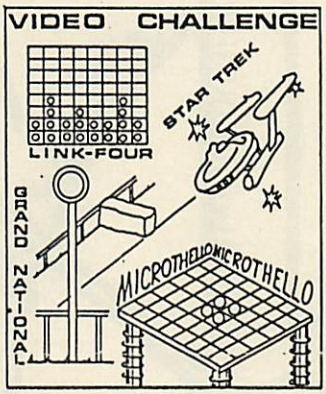
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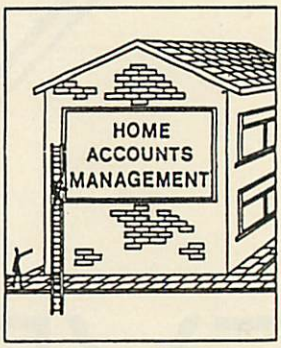
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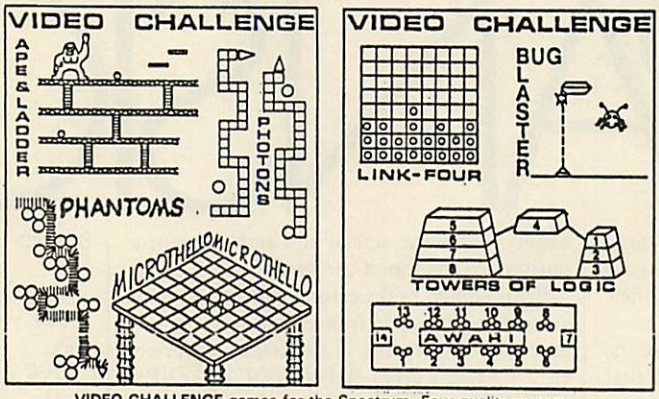
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(continued from page 171)

10 = Pink. 13 = Light green.
11 = Light cyan. 14 = Light blue.
12 = Light purple. 15 = Light yellow.

BDR is the equivalent of the Spectrum's Border command which selects the border colour.

AUX selects the auxiliary colour for multi-colour mode graphics.

Repeat selects which keys on the keyboard you want to repeat.

0 = normal — only cursor controls.
1 = no repeat.
2 = full repeat — all keys repeat.

Pause is the same as the Spectrum command which does exactly what it says — waits for a specified amount of time — 0 to 65535 — 1000 is about one second.

Curset is the same as on the Oric, and is an equivalent of the Spectrum Print At. It sets the cursor position.

Reset resets the Vic as if it were turned on and off with the advantage that you still have the new commands available for Basic.

Kill is the same as the previous command except that you lose the new commands.

Lomem: Unlike the BBC version, this command sets the start of Basic. When used you should Poke or Doke the address before the Lomem one, with a zero e.g.,

```
LOMEM 5120 : DOKE 5119,0 : NEW
```

will set the bottom of memory to 5120.

Himem sets the pointer to the end of a Basic program e.g.,

```
HIMEM 7680
```

sets the end of Basic to 7680.

Setcase enables and disables the shifting between upper and lower case using

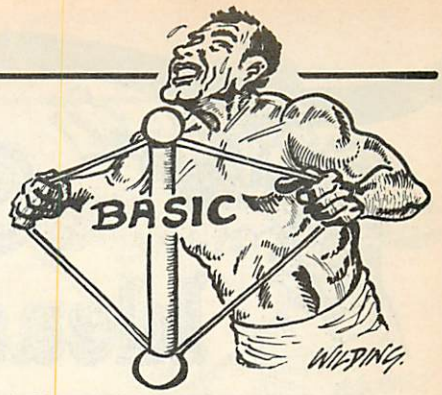
SHIFT COMMODORE

0 = enable.
1 = disable.

Break disables the Run Stop and Restore keys, thus making it impossible to break out of a program.

0 = enabled break.
1 = disabled break.

IRQ alters the IRQ vector to point to a new wedge routine. It should be noted that an IRQ wedge will need to be terminated with "JMP 60095", unless you have your own routine to exit from an interrupt.



It is not advisable to use this command unless you can write your own machine-code routines, otherwise the system could crash and your new Basic must be loaded again.

Beep bears no resemblance to the similar Spectrum command. It actually turns on a keyboard beeper which beeps with every key pressed. The Beep can be turned off with Resume.

Fetch waits until any key is pressed and then continues on with the rest of the program. It is

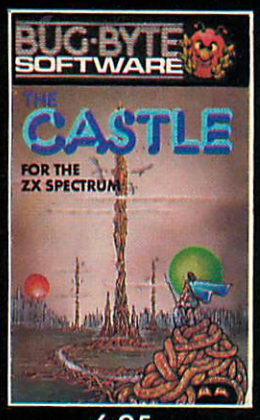
(continued on page 175)

```
 498 REM FILL
 500 DATA20,5D,06,A5,14,85,FA,A5,15,85,FB,20,FD,CE,20,5D,06,A5,14,85,FC,A5,15,85
,FD
 510 DATA20,FD,CE,20,9E,D7,8A,A0,00,91,FA,A6,FB,E4,FD,F0,04,B0,11,D0,06,A6,FA,E4
,FC
 520 DATAB0,09,E6,FA,D0,EA,E6,FB,18,90,E5,20,79,00,C9,2C,D0,06,20,73,00,18,90,B6
,60
 531 REM CLS
 540 DATAA9,93,4C,09,E1
 551 REM ERR
 560 DATA20,9E,D7,E0,00,F0,04,E0,1F,90,03,4C,48,D2,4C,3A,C4
 571 REM WINDOW
 580 DATA20,9E,D7,8E,00,90,20,FD,CE,20,9E,D7,8E,01,90,60
 591 REM SOUND
 600 DATA20,9E,D7,E0,04,90,03,4C,48,D2,86,FF,20,FD,CE,20,9E,D7,A9,F0,2D,0E,90,8A
 610 DATA0D,0E,90,8D,0E,90,20,FD,CE,20,9E,D7,8A,A6,FF,9D,0A,90,20,FD,CE,20,5D,06
,E6,14,E6,15
 620 DATAA0,05,A2,00,CA,D0,FD,88,D0,F8,C6,14,D0,F2,C6,15,D0,EE,A9,00,A6,FF,9D,0A
,90
 630 DATA20,79,00,C9,2C,D0,06,20,73,00,18,90,A6,60
 640 REM MUSIC(
 650 DATAA2,00,8E,00,01,20,9E,D7,A8,8A,AE,00,01,9D,01,01,E8,E0,06,B0,0B,20,73,00
,C0,29
 660 DATAF0,07,C0,2C,F0,E2,4C,08,CF,CA,BD,01,01,9D,0A,90,CA,10,F7,60
 669 REM INK
 670 DATA20,9E,D7,8E,86,02,60
 679 REM PAPER
 680 DATAA9,0F,85,FF,20,9E,D7,A0,01,8A,0A,0A,0A,0A,AA,A5,FF,39,0E,90,99,0E,90,8A
 690 DATA19,0E,90,99,0E,90,60
 699 REM BDR
 700 DATAAD,0F,90,29,F8,8D,0F,90,20,9E,D7,8A,29,07,0D,0F,90,8D,0F,90,60
 709 REM AUX
 710 DATA20,9E,D7,AD,0E,90,29,0F,8D,0E,90,8A,0A,0A,0A,0A,0D,0E,90,8D,0E,90,60
 719 REM REPEAT
 720 DATA20,9E,D7,8A,C9,03,90,03,4C,48,D2,C9,02,F0,0E,C9,01,F0,04,8D,8A,02,60,A9
,40
 730 DATA8D,8A,02,60,A9,80,8D,8A,02,60
 739 REM PAUSE
 740 DATA20,5D,06,E6,14,E6,15,A2,00,CA,D0,FD,C6,14,D0,F7,C6,15,D0,F3,60
 749 REM CURSET
 750 DATA20,9E,D7,86,FF,20,FD,CE,20,9E,D7,8A,A8,A4,FF,18,4C,F0,FF
 759 REM LOMEM
 760 DATA20,5D,06,A5,14,85,2B,A5,15,85,2C,4C,64,C6
 769 REM HIMEM
 770 DATA20,5D,06,A5,14,85,2D,A5,15,85,2E,4C,64,C6
 779 REM SETCASE
 780 DATA20,9E,D7,E0,02,90,03,4C,48,D2,E0,01,D0,06,A9,80,8D,91,02,60,A9,00,8D,91
```

(listing continued on page 175)



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6.95



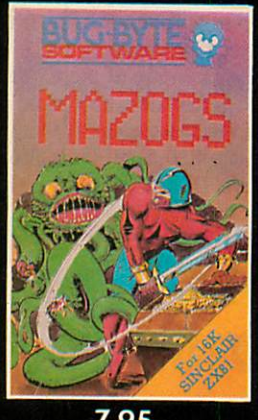
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5.95



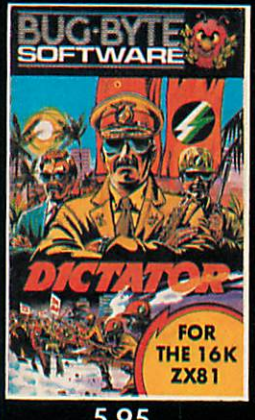
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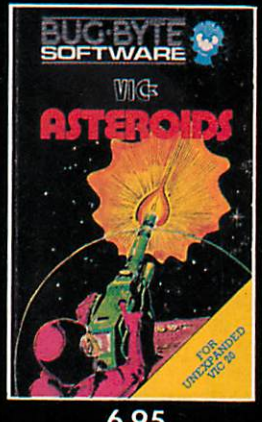
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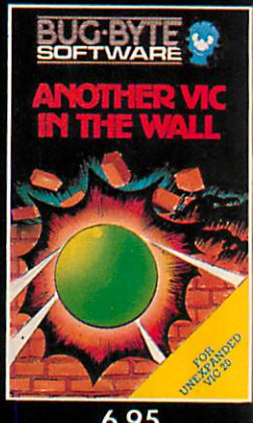
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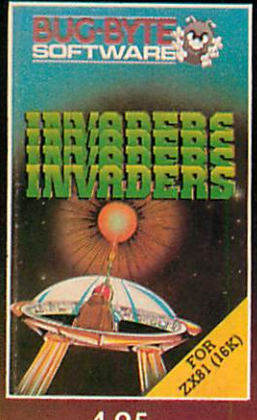
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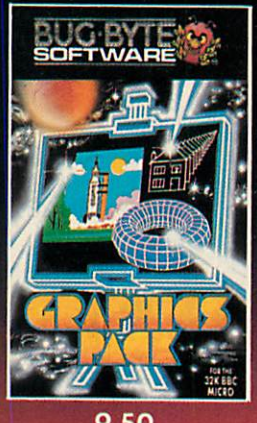
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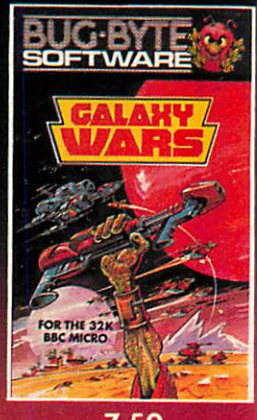
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(continued from page 171)

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Lomem: Unlike the BBC version, this command sets the start of Basic. When used you should Poke or Doke the address before the Lomem one, with a zero e.g.,

LOMEM 5120 : DOKE 5119,0 : NEW

will set the bottom of memory to 5120.

Himem sets the pointer to the end of a Basic program e.g.,

HIMEM 7680

sets the end of Basic to 7680.

Setcase enables and disables the shifting between upper and lower case using

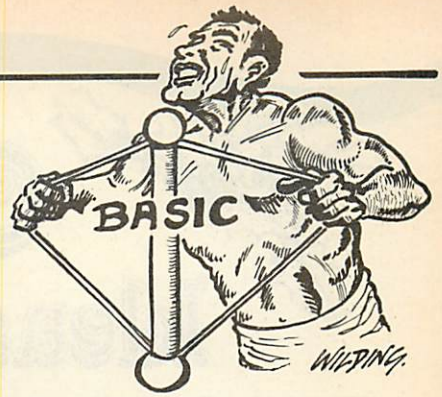
SHIFT COMMODORE

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Fetch waits until any key is pressed and then continues on with the rest of the program. It is

(continued on page 175)

```
 498 REM FILL
 500 DATA20,5D,06,A5,14,85,FA,A5,15,85,FB,20,FD,CE,20,5D,06,A5,14,85,FC,A5,15,85
,FD
 510 DATA20,FD,CE,20,9E,D7,8A,A0,00,91,FA,A6,FB,E4,FD,F0,04,B0,11,D0,06,A6,FA,E4
,FC
 520 DATAB0,09,E6,FA,D0,EA,E6,FB,18,90,E5,20,79,00,C9,2C,D0,06,20,73,00,18,90,B6
,60
 531 REM CLS
 540 DATAA9,93,4C,09,E1
 551 REM ERR
 560 DATA20,9E,D7,E0,00,F0,04,E0,1F,90,03,4C,48,D2,4C,3A,C4
 571 REM WINDOW
 580 DATA20,9E,D7,8E,00,90,20,FD,CE,20,9E,D7,8E,01,90,60
 591 REM SOUND
 600 DATA20,9E,D7,E0,04,90,03,4C,48,D2,86,FF,20,FD,CE,20,9E,D7,A9,F0,2D,0E,90,8A
 610 DATA0D,0E,90,8D,0E,90,20,FD,CE,20,9E,D7,8A,A6,FF,9D,0A,90,20,FD,CE,20,5D,06
,E6,14,E6,15
 620 DATAA0,05,A2,00,CA,D0,FD,88,D0,F8,C6,14,D0,F2,C6,15,D0,EE,A9,00,A6,FF,9D,0A
,90
 630 DATA20,79,00,C9,2C,D0,06,20,73,00,18,90,A6,60
 640 REM MUSIC(
 650 DATAA2,00,8E,00,01,20,9E,D7,A8,8A,AE,00,01,9D,01,01,E8,E0,06,B0,0B,20,73,00
,C0,29
 660 DATAF0,07,C0,2C,F0,E2,4C,08,CF,CA,BD,01,01,9D,0A,90,CA,10,F7,60
 669 REM INK
 670 DATA20,9E,D7,8E,86,02,60
 679 REM PAPER
 680 DATAA9,0F,85,FF,20,9E,D7,A0,01,8A,0A,0A,0A,0A,AA,A5,FF,39,0E,90,99,0E,90,8A
 690 DATA19,0E,90,99,0E,90,60
 699 REM BDR
 700 DATAAD,0F,90,29,F8,8D,0F,90,20,9E,D7,8A,29,07,0D,0F,90,8D,0F,90,60
 709 REM AUX
 710 DATA20,9E,D7,AD,0E,90,29,0F,8D,0E,90,8A,0A,0A,0A,0A,0D,0E,90,8D,0E,90,60
 719 REM REPEAT
 720 DATA20,9E,D7,8A,C9,03,90,03,4C,48,D2,C9,02,F0,0E,C9,01,F0,04,8D,8A,02,60,A9
,40
 730 DATA8D,8A,02,60,A9,80,8D,8A,02,60
 739 REM PAUSE
 740 DATA20,5D,06,E6,14,E6,15,A2,00,CA,D0,FD,C6,14,D0,F7,C6,15,D0,F3,60
 749 REM CURSET
 750 DATA20,9E,D7,86,FF,20,FD,CE,20,9E,D7,8A,A8,A4,FF,18,4C,F0,FF
 759 REM LOMEM
 760 DATA20,5D,06,A5,14,85,2B,A5,15,85,2C,4C,64,C6
 769 REM HIMEM
 770 DATA20,5D,06,A5,14,85,2D,A5,15,85,2E,4C,64,C6
 779 REM SETCASE
 780 DATA20,9E,D7,E0,02,90,03,4C,48,D2,E0,01,D0,06,A9,80,8D,91,02,60,A9,00,8D,91
```

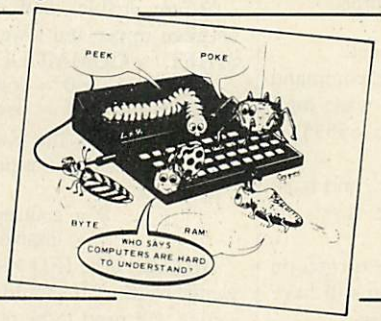
(listing continued on page 175)

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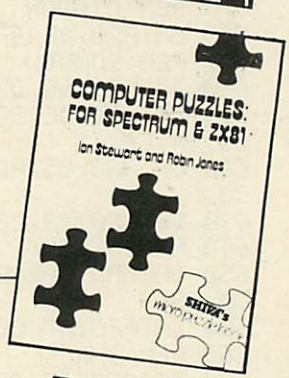
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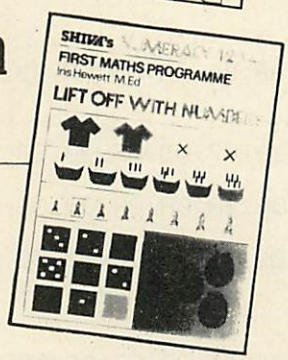
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(continued from page 173)

a great memory saver. The equivalent Basic would be:

```
POKE 198,0 : WAIT 198,1 : POKE 198,0.
```

CLD stands for Code Load. It loads a portion of memory — containing machine code or even graphics or screen displays — into the memory from which it was Saved — using CSV. It should be noted that you do not specify a file name, and that the command is usable only with the cassette recorder.

CSV stands for Code Save and Saves a section of memory to cassette without a file name. X and Y are the start and end Save locations respectively, e.g., to Save a screen display type:

```
CSV 7680, 8185
```

Use CLD to load it back, but make sure the screen is cleared and that it is not white before loading in a screen, otherwise the display could be muddled or invisible.

Boom is similar to the Oric's explode command. It offers easy generation of an explosion sound.

Zap is the Oric sound command which simply Zaps. An interesting effect can be obtained by:

```
FOR X = 0 TO 50 : ZAP : NEXT
```

Ping is similar to the Oric's command. It allows you to specify the pitch and duration of the ping.

X = pitch (128-255)
Y = duration (0-255)

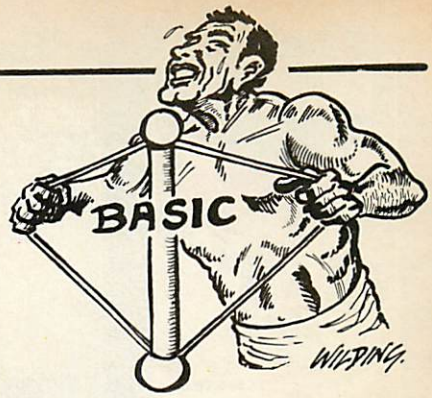
The sound of a marble bouncing on a plate can be synthesised by the following simple line:

```
FOR I = 10 TO 1 STEP -0.4 : PING 220, I : NEXT
```

Mode: Do not be too excited about this command as it will not give you an 80-column display etc. as on the BBC micro, but it does give the following graphics modes:

Hi-res modes
- 0 = UDG Mode 1
- 1 = UDG Mode 2
- 2 = Normal — upper case — mode
- 3 = Lower case
- 4 = Reverse screen mode — upper case
- 5 = Reverse screen mode — lower case

Renumber renumbers a Basic program starting with X and increasing in steps of Y:



X = 0-65535
Y = 0-255

Next month I shall cover the remaining commands and there will be a demonstration game written in the new Basic.

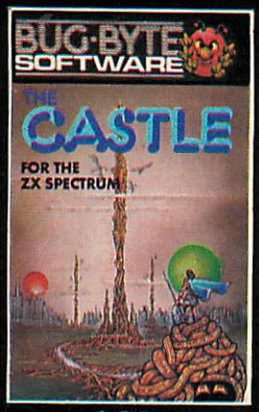
If you would like a cassette of the Extended Basic along with a few demonstration programs and a short reference manual, there is a cassette available for £4.50 from: D. McComb, 23 Woodlawn Drive, Dungannon, Co. Tyrone BT70 1AJ. ■

(listing continued from page 173)

```
,02,60
 789 REM BREAK
 790 DATA20,9E,D7,E0,02,90,03,4C,48,D2,E0,01,D0,0B,A9,02,8D,1E,91,A9,00,8D,89,02
,60
 800 DATAA9,82,8D,1E,91,A9,0A,8D,89,02,60
 809 REM IRQ
 810 DATA20,5D,06,78,A5,14,8D,14,03,A5,15,8D,15,03,58,60
 819 REM BEEP
 820 DATA78,A9,71,8D,14,03,A9,08,8D,15,03,58,60,A9,00,8D,0E,90,8D,0C,90
 830 DATAA5,CB,C5,96,85,96,F0,0E,C9,40,F0,0A,A9,C8,8D,0C,90,A9,0F,8D,0E,90,4C,BF
,EA
 839 REM FETCH
 840 DATAA9,00,85,C6,A5,C6,F0,FC,A9,00,85,C6,60
 849 REM CLD
 850 DATAA9,01,A0,FF,A2,01,20,BA,FF,A9,00,20,BD,FF,4C,D5,FF
 859 REM CSV
 860 DATA20,5D,06,A5,14,85,FE,A5,15,85,FF,20,FD,CE,20,5D,06,A9,01,A0,FF,A2,01,20
,BA,FF
 862 DATAA9,00,20,BD,FF,A9,FE,A6,14,A4,15,4C,D8,FF
 869 REM BOOM
 870 DATAA9,FF,8D,0D,90,A2,0F,8E,0E,90,A2,50,A0,00,88,D0,FD,CA,D0,F8,CE,0E,90,D0
,F1
 875 DATA8C,0D,90,8C,0E,90,60
 879 REM ZAP
 880 DATAAC,0E,90,A9,0F,8D,0E,90,A9,FE,8D,0C,90,A2,00,CA,D0,FD,CE,0C,90,AD,0C,90
,C9,7F
 882 DATAD0,F1,8C,0E,90,60
 889 REM PING
 890 DATA20,9E,D7,8E,0C,90,20,FD,CE,20,9E,D7,86,FF,A9,0F,8D,0E,90,A0,00,A6,FF,CA
,D0,FD
 892 DATA88,D0,F8,CE,0E,90,D0,F1,60
 899 REM MODE
 900 DATA20,9E,D7,E0,06,B0,15,E0,04,90,18,A9,F7,2D,0F,90,8D,0F,90,E0,05,F0,06,A9
,F0,8D
 902 DATA05,90,60,A9,F2,8D,05,90,60,A9,08,0D,0F,90,8D,0F,90,BD,6D,09,8D,05,90,60
,FD,FF,F0,F2
 909 REM RENUMBER
 910 DATA20,EB,D7,86,05,A5,2B,85,03,A5,2C,85,04,A0,00,B1,03,85,FB,C8,B1,03,85,FC
,D0,07
 912 DATAA0,00,B1,03,D0,01,60,A0,02,A5,14,91,03,C8,A5,15,91,03,A5,05,18,65,14,85
,14,90,02
 914 DATAE6,15,A5,FB,85,03,A5,FC,85,04,18,90,CB
 990 DATA
1400 FORI=6235TO7600:READA$:IFA$=""THEN5000
1410 GOSUB10000:POKEI,N:NEXT
5000 PRINT"■■NOW LOAD THE 3RD PART■":POKE2999,0:POKE43,184:POKE44,11:NEW
10000 A=ASC(A$)-48:B=ASC(RIGHT$(A$,1))-48:N=B+7*(B>9)+16*(A+7*(A>9)):RETURN
```



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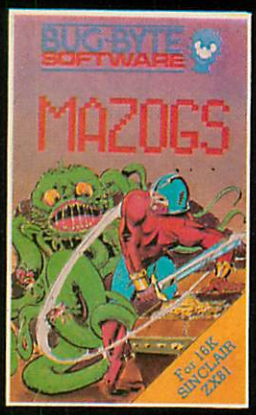
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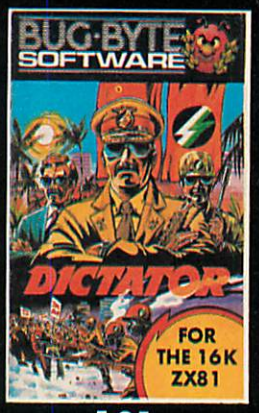
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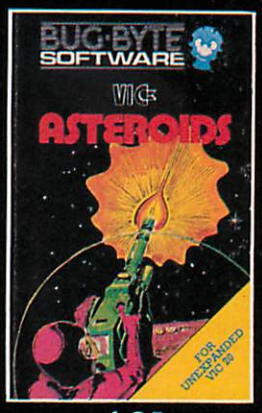
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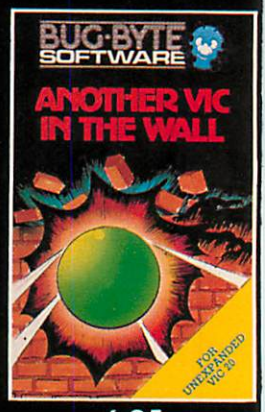
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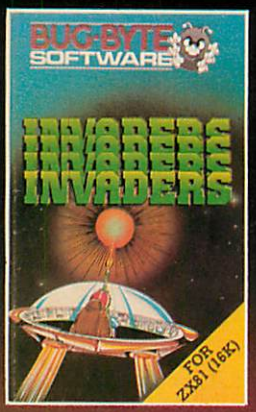
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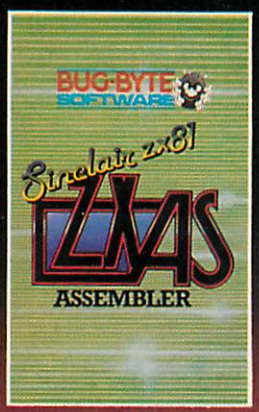
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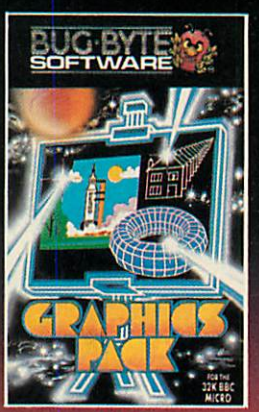
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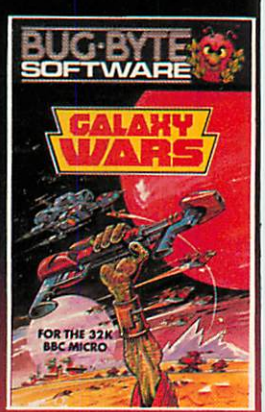
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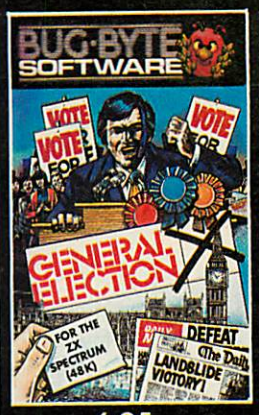
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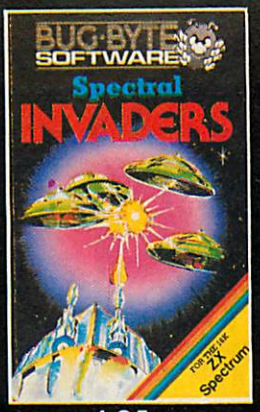
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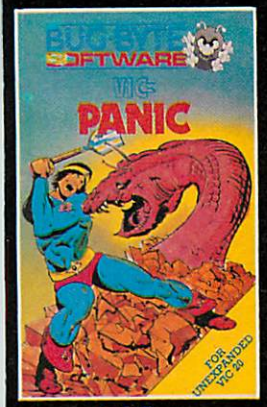
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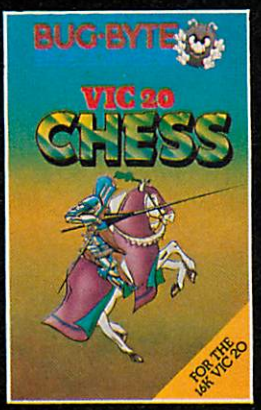
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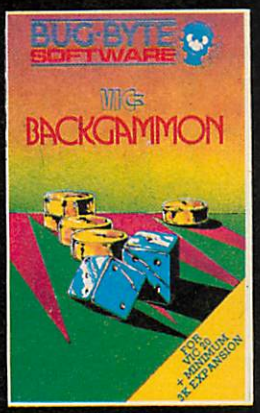
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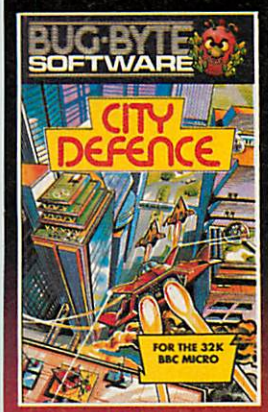
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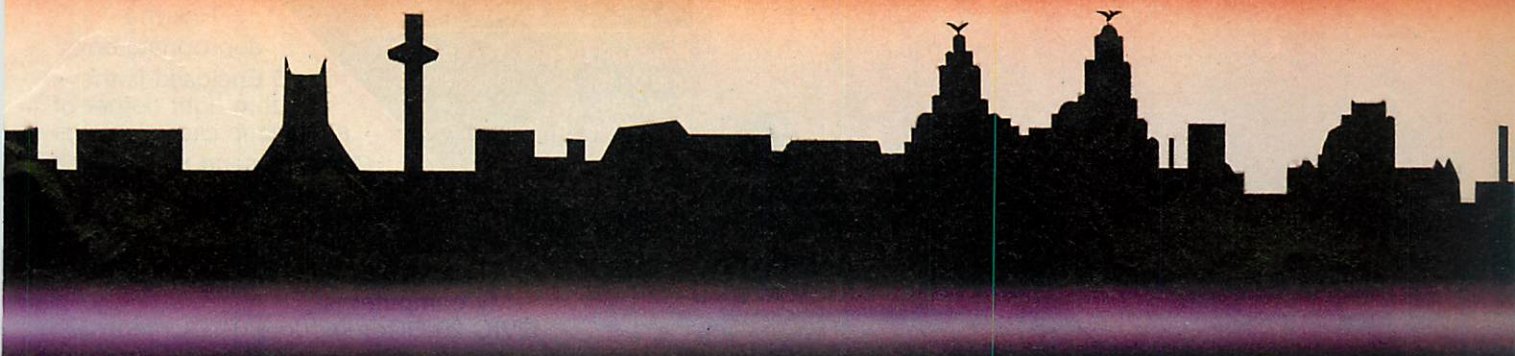
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6809 DRAGON EXPRESS

John Nash concludes his look at 6809 Dragon machine code with examples.

2A.

```
7E00                    00100          ORG     $7E00
7E00 CC   0000          00110 START    LDD     #0
7E03 FD   7FFC          00120          STD     $7FFC    CLEAR LINE CTR.
7E06 CC   0060          00130          LDD     #$60     3 LINES
7E09 F3   7FFE          00140          ADDD    $7FFE    GET ADDRESS OF NEXT LINE
7E0C 10B3 7FFA          00150          CMPD    $7FFA    REACHED END?
7E10 24   1C            00160          BHS     $7E2E    YES: RETURN
7E12 FD   7FFE          00170          STD     $7FFE    ELSE STORE IT
7E15 BE   7FFE          00180          LDX     $7FFE    TO INDEX REG.
7E18 C6   01            00190          LDB     #1       SCREEN POKE CODE
7E1A A6   84            00200          LDA     ,X       GET EXISTING SCREEN CONTENT
7E1C 81   00            00210          CMPA    #$0      ZERO?
7E1E 26   E0            00220          BNE     $7E00    NO:GET NEXT LINE (REACHED RIGHT
ON LINE)
7E20 E7   80            00230          STB     ,X+      ELSE POKE SCREEN
7E22 7C   7FFC          00240          INC     $7FFC    INC. COLUMN COUNTER
7E25 F6   7FFC          00250          LDB     $7FFC
7E28 C1   20            00260          CMPB    #$20     FINISHED ROW?
7E2A 27   D4            00270          BEQ     $7E00    YES: DO NEXT
7E2C 20   EA            00280          BRA     $7E18    NO, GO ON
7E2E 39                 00290          RTS              HOME & DRY.
          0000          00300          END
00000 TOTAL ERRORS

START   7E00
```

2B.

```
7E70                    00100          ORG     $7E70
7E70 108E 10CF          00110 START    LDY     #$10CF   GET SCREEN POSN.
7E74 8E   7F60          00120          LDX     #$7F60   START OF DATA
7E77 A6   80            00130          LDA     ,X+      GET NEXT VALUE
7E79 A7   A0            00140          STA     ,Y+      PRINT IT
7E7B A6   80            00150          LDA     ,X+
7E7D A7   A0            00160          STA     ,Y+      REPT. 3 TIMES
7E7F A6   80            00170          LDA     ,X+
7E81 A7   A4            00180          STA     ,Y
7E83 31   A8 1E         00190          LEAY    $1E,Y    ADD 30 TO Y FOR NEXT RUN START
7E86 108C 132E          00200          CMPY    #$132E   ?DONE ALL
7E8A 24   02            00210          BHS     $7E8E    YES: QUIT
7E8C 20   E9            00220          BRA     $7E77    NO: CONT.
7E8E 39                 00230          RTS              LEAVE
          0000          00240          END
00000 TOTAL ERRORS
START   7E70
```

THE BEST PLACE in RAM for machine-code routines is usually at the end, but you may have to put them earlier if using a disc or other system which monopolises the last section of RAM. Normally, however, you will want to put the machine code as near the end of memory as possible, to economise on space.

Basic has a command to set the top address available to the Basic system: Clear. Used as, for example,

CLEAR 1000,32256

This sets 1000 bytes aside for string storage, and excludes the Basic system from addresses above 32255. Your machine code routine will thus be safe from overwriting. Note that you can still Poke to addresses in the reserved area. Having reserved the space, you then need to assemble the code to that area, either by Poking the codes into the relevant addresses, or by using an assembler directive such as Org — origin — which tells the assembler where to locate the code.

Next, you need to call the routine from Basic, which is most conveniently done with an

EXEC NNNNN

instruction, where NNNNN is the starting address of your routine. USR is another possibility, but on my Dragon and, I believe, many early machines, only USR0 will work. You will probably want to pass parameters — put values into the machine code routine from the Basic program.

You can do this by Poking to an address which the machine code can also get at. Of course, you have to Poke both bytes if it is a 16-bit number you are transferring; and these must be split correctly for hexadecimal notation. Suppose you wanted to store 30010 (decimal) into addresses 32250 and 32251. The following sequence would achieve this:

```
H=INT(30010/256):L=30010-(H*256)
```

followed by

```
POKE 32250,H:POKE 32251,L
```

An instruction such as

```
LDD 32250
```

will then retrieve the correct value and put it in the D register. To transfer numbers back from machine code to Basic, store them in a RAM address before leaving, e.g., 31788, and then use the following Basic sequence:

```
V=PEEK(31788)*256+PEEK(31789)
```

which puts the answer into a variable V.

You can do the same thing with strings using the useful Varptr Basic instruction. This tells you where the pointers for a variable are stored, as follows:

VARPTR(A$)

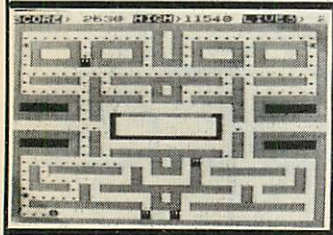
gives you an address X: the addresses we are interested in are X+2 and X+3 which contain the high and low byte of the start of A$. These can be Poked in the same way, and your machine code can then access A$ in the form of a table of bytes in successive addresses. For an example of both number and string Pokes in use, see my word processor listing, *Your Computer*, June 83.

When considering what addresses to use for

(continued on page 181)

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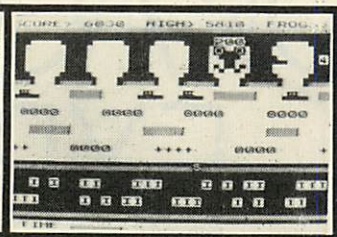
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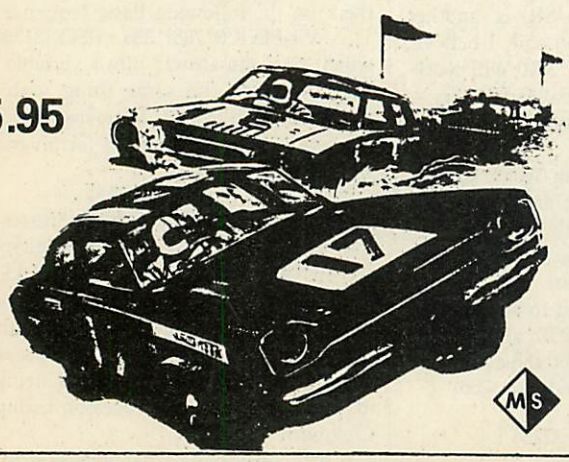
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2C.

```
7E90                    00100          ORG     $7E90
7E90 8E   1800        00110 START    LDX     #$1800   TOP OF INST. PANEL
7E93 108E 1900        00120          LDY     #$1900   1 LINE LOWER
7E97 A6   A0          00130          LDA     ,Y+      PICK UP VALUE
7E99 A7   80          00140          STA     ,X+      MOVE IT DOWN
7E9B 108C 1E00        00150          CMPY    #$1E00   REACHED BOTTOM
7E9F 24   02          00160          BHS     $7EA3    YES, GO TO MOVE-UP
7EA1 20   F4          00170          BRA     $7E97    NO, GO ON
7EA3 8E   1D00        00180          LDX     #$1D00   1 LINE FROM BOTTOM
7EA6 108E 1E00        00190          LDY     #$1E00   BOTTOM
7EAA A6   82          00200          LDA     ,-X
7EAC A7   A2          00210          STA     ,-Y      MOVE UP
7EAE 8C   1800        00220          CMPX    #$1800   REACHED TOP OF PANEL?
7EB1 23   02          00230          BLS     $7EB5    YES, QUIT
7EB3 20   F5          00240          BRA     $7EAA    NO, REPEAT
7EB5 39               00250          RTS              LEAVE
          0000        00260          END
00000 TOTAL ERRORS

START   7E90
```

2D.

```
7F00                    00100          ORG     $7F00
7F00 86   C8          00110 START    LDA     #$C8     SQUARE WAVE
7F02 C6   20          00120          LDB     #$20     (A-B) GIVES VOLUME
7F04 CE   0000        00130          LDU     #$0
7F07 B7   FF2C        00140 LOOP     STA     $FF2C    OUPUT REG.
7F0A 8E   00FF        00150          LDX     #$00FF   X CONTROLS FREQUENCY
7F0D 30   1F          00160 DELAY    LEAX    -1,X
7F0F 8C   0040        00170          CMPX    #$40     ?DELAY DONE
7F12 26   F9          00180          BNE     DELAY    NO
7F14 F7   FF2C        00190          STB     $FF2C    DROP LEVEL
7F17 33   41          00200          LEAU    1,U      TONE LENGTH
7F19 1183 01F4        00210          CMPU    #$1F4    ?TONE DONE
7F1D 24   02          00220          BHS     OUT
7F1F 20   E6          00230          BRA     LOOP
7F21 39               00240 OUT      RTS
7F22 86   00          00250 TRIANG   LDA     #$0      TRIANGULAR WAVE
7F24 CE   0000        00260          LDU     #$0
7F27 B7   FF3C        00270 UPLOOP   STA     $FF3C
7F2A 4C               00280          INCA            RAMP
7F2B 81   9B          00290          CMPA    #$9B     ?REACHED TOP
7F2D 27   02          00300          BEQ     DNLOOP
7F2F 20   F6          00310          BRA     UPLOOP
7F31 4A               00320 DNLOOP   DECA            RAMP
7F32 B7   FF3C        00330          STA     $FF3C
7F35 81   00          00340          CMPA    #$0      ?BOTTOM
7F37 27   02          00350          BEQ     NEXT
7F39 20   F6          00360          BRA     DNLOOP
7F3B 33   41          00370 NEXT     LEAU    1,U
7F3D 1183 01F4        00380          CMPU    #$1F4    TONE LENGTH
7F41 24   02          00390          BHS     ROUT
7F43 20   E2          00400          BRA     UPLOOP
7F45 39               00410 ROUT     RTS
          0000        00420          END
00000 TOTAL ERRORS

DELAY   7F0D
DNLOOP  7F31
LOOP    7F07
NEXT    7F3B
OUT     7F21
ROUT    7F45
START   7F00
TRIANG  7F22
UPLOOP  7F27
```

2E.

```
7E00                    00100          ORG     $7E00    PRINT WALLS
7E00 8E   0600        00110          LDX     #$600    START OF STORE
7E03 108E 0400        00120          LDY     #$400    START OF SCREEN
7E07 A6   80          00130 LOOP     LDA     ,X+      GET STORED CHAR.
7E09 8C   07FF        00140          CMPX    #$7FF    END OF STORE
7E0C 27   0C          00150          BEQ     OUT
7E0E 81   80          00160          CMPA    #$80     ?WALL
7E10 27   04          00170          BEQ     PRINT
7E12 E6   A0          00180          LDB     ,Y+      INC. Y
7E14 20   F1          00190          BRA     LOOP
7E16 A7   A0          00200 PRINT    STA     ,Y+      PRINT WALL
7E18 20   ED          00210          BRA     LOOP
7E1A 39               00220 OUT      RTS
7E1B 8E   0400        00230          LDX     #$400    STORE WALLS: START OF SCREEN
7E1E 108E 0600        00240          LDY     #$600    STORE START
7E22 A6   80          00250 STLOOP   LDA     ,X+
7E24 A7   A0          00260          STA     ,Y+      GET & STORE CHAR.
7E26 8C   05FF        00270          CMPX    #$5FF    END OF SCREEN
7E29 27   02          00280          BEQ     STOUT
7E2B 20   F5          00290          BRA     STLOOP
7E2D 39               00300 STOUT    RTS
          0000        00310          END
00000 TOTAL ERRORS

LOOP    7E07
OUT     7E1A
PRINT   7E16
STLOOP  7E22
STOUT   7E2D
```

2F.

```
00810 START   LDA     #128     SET BIT7
00820         STA     TEST
00830 MLOOP   LDU     #$FFFF   -1
00840         LDD     CBYTE    GET COLUMN POINTER
00850         STD     SBYTE    STORE IT
00860 LOOP    LEAU    1,U      COUNTER FOR BITS
00870         LDA     [SBYTE]  GET ADDR. CONTENT
00880         ANDA    TEST     TEST BIT SET
00890         CMPA    #0       WAS IT?
00900         BEQ     CONT1    NO, DO NEXT
00910         LDD     #TABLE   YES, STORE ANSWER
00920         STU     TEMP     BYTE FROM
00930         ADDD    TEMP     TABLE
00940         STD     TEMP
00950         LDB     [TEMP]   AND SET BIT
00960         ADDB    RESULT   OF RESULT
00970         STB     RESULT
00980 CONT1   LDD     SBYTE
00990         ADDD    #32      ELSE GET NEXT ROW
01000         STD     SBYTE
01010         CMPU    #6       HAVE WE GOT ALL 7?
01020         BEQ     NEXT     YES
01030         BRA     LOOP     NO
01040 NEXT    JSR     LORDPR   PUT BYTE IN PRINTER
01050         CLRA
01060         STA     RESULT   RESET RESULT
01070         LEAX    1,X      BIT COUNTER HORIZONTAL
01080         CMPX    #8       ?WHOLE BYTE DONE?
01090         BEQ     OUT      YES
01100         LDA     TEST     NO
01110         LSRA             SHIFT RIGHT TO GET NEXT COLUMN
01120         STA     TEST     RESET TEST REG.
01130         BRA     MLOOP    %CONTINUE
```

2G.

```
              176E    00090 COUNT    EQU     5998     DECIMAL ADDRESSES
              176C    00091 SOURCE   EQU     5996
              176A    00092 DESTIN   EQU     5994
              1768    00093 LIMIT    EQU     5992
              1766    00094 CADDR    EQU     5990
              1748    00095 TABLE    EQU     5960
              1764    00096 TEMP     EQU     5988
              1762    00097 TEMP4    EQU     5986
              1760    00098 TEMP2    EQU     5984
              7FFF    00099 ENDP     EQU     $7FFF
157C                  00100          ORG     $157C
157C FC   1768        00110 INSERT   LDD     LIMIT    GET CURRENT END OF FILE
157F B3   1766        00120          SUBD    CADDR    SUBTRACT CURRENT POSN.
1582 1F   03          00130          TFR     D,U      TO COUNTER
1584 33   41          00140          LEAU    1,U      INC. CTR.
1586 BE   1768        00150          LDX     LIMIT
1589 FC   1768        00160          LDD     LIMIT
158C C3   0001        00170          ADDD    #$1
158F FD   1768        00180          STD     LIMIT    INC. LIMIT
1592 10BE 1768        00190          LDY     LIMIT    OLD LIMIT IN X, NEW IN Y
1596 30   01          00200          LEAX    1,X
1598 31   21          00210          LEAY    1,Y
159A A6   82          00220 ILOOP    LDA     ,-X
159C A7   A2          00230          STA     ,-Y      MOVE CHARACTER
159E 33   5F          00240          LEAU    -1,U
15A0 1183 0000        00250          CMPU    #$0      MOVED ALL?
15A4 27   00          00260          BEQ     INEXT    YES
15A6 FC   176E        00280 INEXT    LDD     COUNT    NOW MAKE SPACE FOR NEXT CHAR
15A9 83   0001        00290          SUBD    #$1
15AC FD   176E        00300          STD     COUNT    DEC. COUNT
15AF CC   0000        00310          LDD     #$0
15B2 10B3 176E        00320          CMPD    COUNT    FINISHED ALL?
15B6 27   02          00330          BEQ     IOUT
15B8 20   C2          00340          BRA     INSERT
15BA 39               00350 IOUT     RTS
15BB FE   176E        00360 BMOVE    LDU     COUNT    BLOCK MOVE ROUTINE
15BE BE   176C        00370          LDX     SOURCE
15C1 10BE 176A        00380          LDY     DESTIN
15C5 A6   80          00390 MLOOP    LDA     ,X+
15C7 A7   A0          00400          STA     ,Y+      MOVE IT
15C9 33   5F          00410          LEAU    -1,U
15CB 1183 0000        00420          CMPU    #$0      ?DONE
15CF 27   02          00430          BEQ     MOUT     YES
15D1 20   F2          00440          BRA     MLOOP    NO
15D3 39               00450 MOUT     RTS
15D4 8E   6000        00460 CLEARM   LDX     #$6000   CLEAR TEXT MEMORY
15D7 86   20          00470          LDA     #$20     CODE FOR SPACE
15D9 A7   80          00480 CLOOP    STA     ,X+      STORE A SPACE (CLR.CLEAR)
15DB 8C   7FFF        00490          CMPX    #$7FFF   END OF RAM
15DE 24   02          00500          BHS     COUT
15E0 20   F7          00510          BRA     CLOOP
15E2 39               00520 COUT     RTS
15E3 CE   0065        00530 START    LDU     #$65     SET BEGINNING OF USER STACK
15E6 108E 1748        00540          LDY     #TABLE   GET TABLE ADDRESS
15EA E6   A0          00550          LDB     ,Y+      FIRST SEARCH CHAR.
15EC F7   1764        00560          STB     TEMP     STORE TEMP.
15EF 8E   1762        00570          LDX     TEMP4    SET BY LOADER TO CONTAIN END OF
FILE ADDRESS
15F2 A6   80          00580 LOOP     LDA     ,X+      GET FILE CHAR.
15F4 B1   1764        00590          CMPA    TEMP     ?SAME AS TEST$
15F7 27   07          00600          BEQ     SAME
15F9 8C   7FFF        00610          CMPX    #ENDP    ?REACHED RAM END
15FC 27   1C          00620          BEQ     DONEIT
15FE 20   F2          00630          BRA     LOOP     NO
1600 36   30          00640 SAME     PSHU    Y,X      STORE TABLE & FILE POINTERS
1602 A6   A0          00650 CONT     LDA     ,Y+
1604 B7   1760        00660          STA     TEMP2    TEMP. STORE
1607 81   23          00670          CMPA    #$23     CHAR. AT END OF TEST$
1609 27   0D          00680          BEQ     OUT
160B A6   80          00690          LDA     ,X+      ELSE NEXT
160D B1   1760        00700          CMPA    TEMP2    CHECK NEXT CHAR. FOR MATCH
1610 27   F0          00710          BEQ     CONT
1612 20   00          00720          BRA     BACK     ELSE GO BACK
1614 37   30          00730 BACK     PULU    X,Y      UNSTACK THE POINTERS
1616 20   DA          00740          BRA     LOOP     &CONT.
1618 37   30          00750 OUT      PULU    X,Y
161A BF   1762        00760 DONEIT   STX     TEMP4    ANSWER TO TEMP4
161D 39               00770          RTS     REST OF PROGRAM JOINS ON HERE
          0000        00780          END
00000 TOTAL ERRORS
```

BACK	1614
BMOVE	15BB
CADDR	1766
CLEARM	15D4
CLOOP	15D9
CONT	1602
COUNT	176E
COUT	15E2
DESTIN	176A
DONEIT	161A
ENDP	7FFF
ILOOP	159A
INEXT	15A6
INSERT	157C
IOUT	15BA
LIMIT	1768
LOOP	15F2
MLOOP	15C5
MOUT	15D3
OUT	1618
SAME	1600
SOURCE	176C
START	15E3
TABLE	1748
TEMP	1764
TEMP2	1760
TEMP4	1762

(continued from page 179)

storage, you are safe using any above the partition – reserved area – which are not actually part of the machine code program. I usually leave several addresses clear at the end for this purpose. Assemblers will allow you to reserve storage bytes in the program, using pseudo-operators such as FCC, FCB, FDB and RMB.

Often, you can also define symbols as numeric values using EQU or Set. The assembler will also usually allow you to attach labels to addresses, e.g. Start could be the first address of your routine. No doubt there is some variation in assemblers, and the above remarks apply to the Tandy one that I use.

Saving to tape: This is the standard method for machine code files, in which you must specify the file NAME; START; END and length. e.g.,

CSAVEM "MCFILE", 32256, 32767, 512

would store 32256 to the end of RAM. Note that the number stored is one more than – FINISH-START – as we want to store the two bytes at the ends as well. To reload, first

CLEAR 200,32256

– remember the first number is the length of string storage – then type CLoadm and reload from tape. No offset is needed unless you want to move the code elsewhere. Now you can load the Basic with CLoad, which will not interfere with the machine code.

(continued on page 183)

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SPECTRUM DRAGON
BBC ZX81

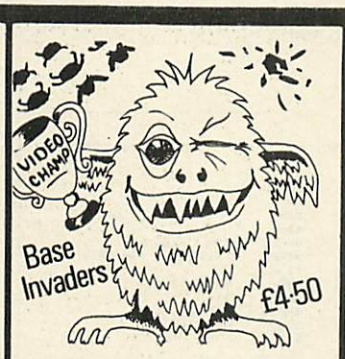
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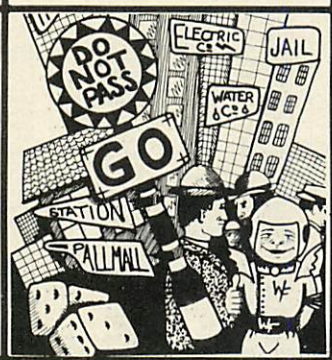
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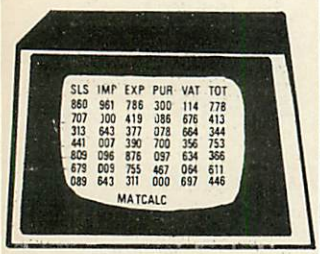
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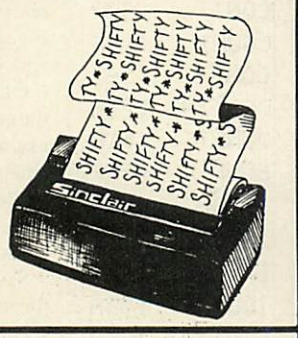


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LUTON BEDS.

Post Included

(continued from page 181)

The high resolution screens use the area of RAM between 1536 and 7679 — $600 to $1DFF. Another area that can be used and then rapidly downloaded by Basic is from 7680 to 13823 — $1E00 to $35FF. This upper area is not displayed on the screen, but can be copied, a page — 1536 bytes — at a time by the PCopy command. The correlation between PMode, image size in pixels, and storage needed is shown in Table 1. The colour modes — 1 and 3 — use two bits for every image element but the monochrome models — 0, 2 and 4 — use only one bit.

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This routine could be modified to scroll left, by storing the left hand column, reading the bytes from left to right, and storing each one space to the left — one address lower — and then reading the stored end column back to the right hand end of the screen. You might like to try this. Scrolling up and down is simpler, because you will not usually need wraparound, so is merely a matter of moving each address up or down by 32 — $20,

Do not forget that to scroll down, you must start from the bottom of the screen, otherwise you would overwrite the addresses you had not yet moved; the opposite is true for scrolling up. The screen is always 32 bytes — $20 — across, in any resoltuion, and there is a choice of number of rows of 192 — PModes 2, 3 and 4 — or 96 — PMode 0, 1 — see Table 1. This means that lateral scrolling will jump one whole column — 1/32 of screen width — at a time, while the verticle will be smoother at 1/192 or 1/96 of screen height each time.

To make the lateral scroll smoother would be complicated because you would have to move the characters one bit at a time, by a binary shift technique. When they jump from one byte to the next the numerical value of the bit goes from 1 to 128 over one pixel, which needs a fancy routine to calculate it — probably not really worth the trouble involved!

Here I shall give an outline of how to produce sounds: the sound registers are located in the I/O area of memory, and I have found that addresses 65324, 65328, 65332, 65336 and 65340 work satisfactorily to produce an output on the cassette channel. Hexadecimal version of these are $FF2C; $FF30, $FF34, $FF38, $FF3C.

Briefly, what you need to do is put an alternating value in the output address — any of the five will work — and you get a "plop" for each change in value, whose loudness depends on the size of the change. Use a loop to Poke say 50 and 200 into the address alternately, and you will get a square wave tone: you can change the frequency by putting in a delay loop on a separate counter — see example below. For a smoother wave, you could try the other routine shown, which gradually increases and then decreases the contents of the address. This will also work from Basic if you want to try, but the frequency is rather low as the Poking is too slow.

There are some other useful addresses to which you can Poke values: these control the screen display and are set up by commands such as Screen, PMode. Their functions are shown in table 3. Only some of the available modes are used by Basic, and you might like to experiment with the others. The advantage of Poking these addresses is that you can switch on the high resolution or text screen while in machine code without returning to Basic, e.g.

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LDA #0 LDX #$FC1 STA ,X
  LDX #$FFC2 STA ,X LDA #$FF
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would switch on the PMode4, Screen1, 1 screen.

The text screen — 1024 to 1535, $400 to $5FF — is much simpler, and you can write to this by Poking ASCII codes straight to the addresses. You may be surprised to note that some of the characters come out in inverse form — this is because the Dragon uses some different codes for the keyboard and display. My word processor program shows how this can be adjusted — see the section entitled Screen, which changes some codes using two small routines called CCH and CCH2. These are needed only when printing to the screen — the codes are correct for the line printer without modification.

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&8006 is the keyboard scanning routine. If a key is pressed the code is returned in A. Use a repeating machine code loop and only exit when A<>0.

```
START JSR $8006 CMPA #0 BEQ START RTS
```

would achieve this.

$8012 is the joystick reading routine, and stores their four values in $15A to $15D from where you can claim them.

$800F is the printer call, and prints the character whose code is in A. ■

Table 1. High resolution screens.

PMode	Pixels	Bits/Pixel	Addresses
0	128*96	1	1536-3071
1	128*96	2	1536-4607
2	128*192	1	1536-4607
3	128*192	2	1536-7679
4	256*192	1	1536-7679

The colours are coded as:

Colour	Bit Code
GREEN/BUFF	00
YELLOW/CYAN	01
BLUE/MAGENTA	10
RED/ORANGE	11

Table 2. Machine code program listing examples.

2A. Paint routine from aerobatic simulator. Fills in the ground with dashes — bit-0 of each address set.

2B. Explosion printer from aerobatic simulator. Uses data stored at $7F60 onwards, and copies it to the centre of the screen.

2C. Panel shake routine from aerobatic simulator. Scrolls the bottom quarter of the screen up then down.

2D. Sound routines.

2E. Wall storing and reprinting routines from ghost maze game. The text screen is stored in 1536 to 2047 at the beginning of the game, and then copied back each turn as a special kind of "CLS".

2F. Fragment of screen to printer dump: this cannot be assembled on its own, so no codes are given. It illustrates the method of bit handling for, in this case, converting 7 bytes arranged in a vertical column into 8 bytes, each running vertically from bit-0 at the top — for Seikosha printer.

2G. Word processor routines to illustrate how to move text around the RAM, and search routine to illustrate stack use.

Table 3. Display addresses in I/O area of RAM.

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DISP 0	POKE65472,0	POKE65473,0
DISP 1	POKE65474,0	POKE65475,0
DISP 2	POKE65476,0	POKE65477,0
DISP 3	POKE65478,0	POKE65479,0

Effects on screen display — 1 Page = 1536 addresses.

Set	Pages on screen
DISP 0, 1, 2	5 spread out
DISP 0, 1	3 coherent
DISP 0, 2	5 coherent
DISP 0	2 coherent
DISP 1, 2	4 usual mode
DISP 1	2 4× magnification
DISP 2	2 2× magnification
ALL CLEAR	1 very coarse res.

DISP 3 determines whether the text screen is included int he top quarter screen — set = no, clear = yes. You will also need to set 65314:

Contents of 65314 — $FF22:

SCREEN	1,0	1,1
PMODE4	247	255
PMODE3	231	239
PMODE2	215	223
PMODE1	199	207
PMODE0	183	191

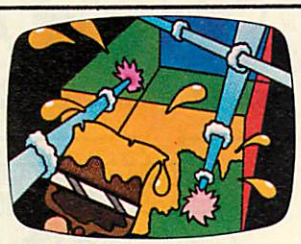
Poking 7 to this register will switch on the text screen.

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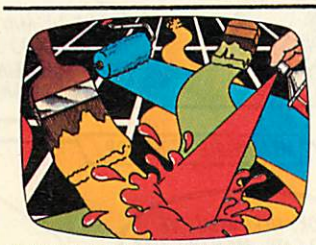


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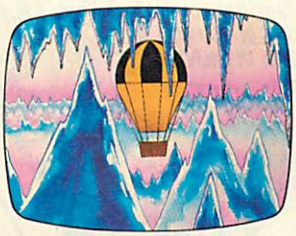


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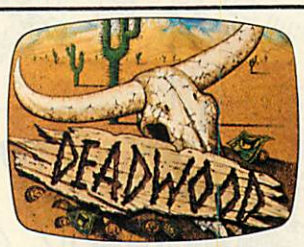


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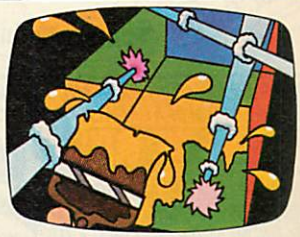


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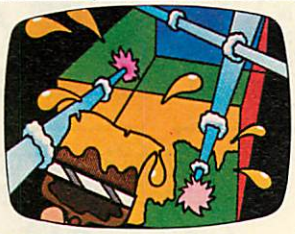
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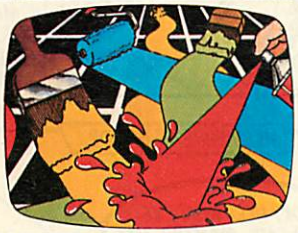


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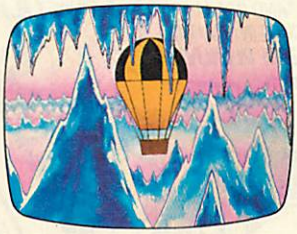


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IN THE GAME Balloons someone is tossing water filled balloons across the screen. Your job is to fire darts trying to bust the balloons. Do not hit the birds though, you will lose points rather than gain them. Allowances must be made for the wind which changes speed and direction every round. At the beginning of the game you are offered a menu you can use to change playing parameters of the game. Try the default parameters first to get used to the game and then try varying parameters.

The whole game could have been written using just the main X-Y movement routine — data in lines 270 to 302 — but, because of the timing between Basic and the Vertical Blank Interrupt, motion would not be smooth. For smooth motion separate routines have been put in the VBI. The three balloons — three players — have their horizontal position updated by a routine using data from lines 262 and 263. Speed is determined by 1572 to 1574 with negative numbers indicating motion to the left. When players reach specified limits their horizontal positions are set to zero to remove them from the screen.

Another routine — data from 264 to 266 — handles dart movement. The number of vertical moves before a horizontal one is specified by WIND — 1576 — while direction is indicated by DIR — 1577 — and speed by SPED3 — 1575. When a vertical limit is reached the dart is replaced at the starting position.

Table 1.

0600- 0609 (1536-1545) VBI insertion routine
060A (1546) Temp variable
060B (1547) PM area Hi byte
060C-060F (1548-1551) Old image numbers
0610-0613 (1552-1555) New image numbers
0614-0617 (1556-1559) Horizontal positions
0618-061B (1560-1563) Old vertical positions
061C-061F (1564-1567) New vertical positions
0620-0623 (1568-1571) Flags for players
0624-0627 (1572-1575) Speed of players
0628 (1576) WIND
0629 (1577) DIR
062A (1578) FLAG4
062B (1579) FLAG5
062C-062F Reserved for future use
0630 and up (1584) Image pointers Lo & Hi bytes

One last job for the VBI routine; in line 261 is a routine that puts the horizontal position of the players in sound frequency registers. It also puts the vertical position of the dart into a sound register if the dart movement routine is active. These actions help considerably in generating smoothly varying pitches which would be impossible using Basic because Pokes are not fast enough.

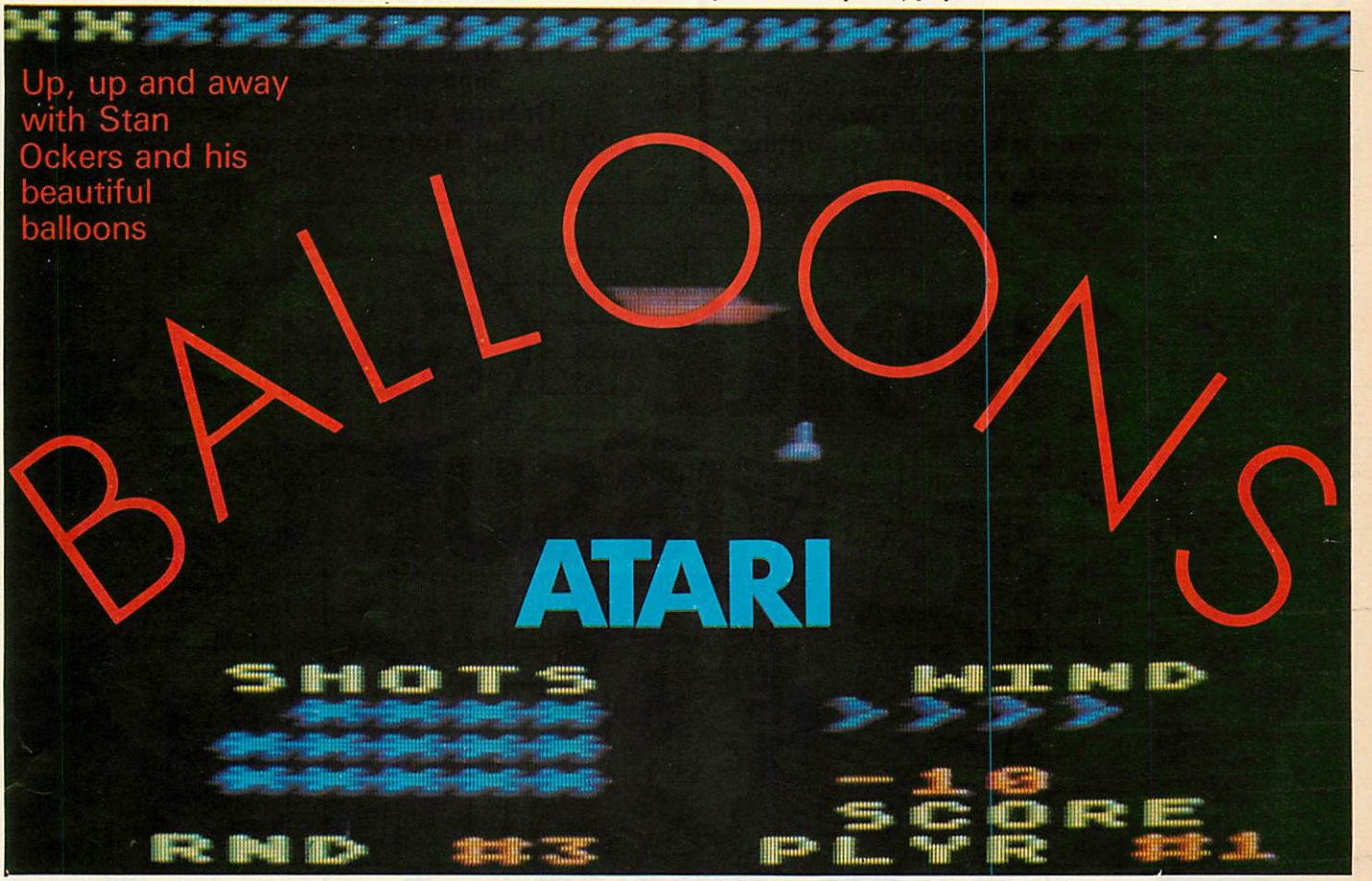
Locations 1536 to 1791 — decimal — in the Atari — $600-6FF — are known as Page Six — 256 — $FF — bytes not used by the operating system. The space can therefore be used for machine language subroutines, special character sets etc. The only catch to watch out for is that if an Input statement retrieves more than 128 bytes, the o/s uses 1536 to 1663 as a buffer for the excess chars, overwriting your code. Therefore keep any inputs less than 128 chars . . . but it does not apply in this program. See lines 100 to 120.

Locations 53760 to 54015 decimal — D200-D2FF — control Pokey, the digital I/O chip that controls the audio frequency and control registers. See lines 120 to 130.

Location 559 — SDMCTL — is the DMA — direct memory access — enable. Poking with 0 allows you to turn off Antic and speeds up processing by 30 percent. Note that the screen goes blank when Antic is turned off.

Location 53277 — GRACTL — turns on players, missiles, and latches trigger inputs.

Locations 704 to 707 set the colours of players 0 to 3. See line 140.




```
10 REM **********************
20 REM ** SHOOTING GALLERY **
30 REM **   STAN OCKERS    **
40 REM **********************
90 ? "JUST A SEC..."
100 PMHI=1547:IMAGE0=1552:IMAGE1=1553:IMAGE2=1554:IMAGE3=1555:HPOS3=1559:VP
OS3=1567
110 FLAG0=1568:FLAG1=1569:FLAG2=1570:FLAG3=1571:FLAG4=1578:FLAG5=1579:WIND=
1576:DIR=1577
120 SPEED0=1572:SPEED1=1573:SPEED2=1574:SPEED3=1575:IMGPNT=1584:SIZEP3=5325
9:P3PL=53263:AUDC1=53761
130 AUDC2=53763:AUDC3=53765:AUDC4=53767:RAMTOP=106:PMBASE=54279:SDMCTL=559:
GRACTL=53277
140 PCOLR0=704:PCOLR1=705:PCOLR2=706:PCOLR3=707
150 NR=5:ROUND=1:DIF=4:DLY=10:DSPD=10:WAIT=20:AMMO=15:NP=1:BPR=0.4
200 OPEN #1,4,0,"K"
250 REM * VBI ROUTINE UPDATED BY POKES *
260 DIM VB$(348):FOR I=1 TO 348:READ A:VB$(I,I)=CHR$(A):NEXT I
261 DATA 173,20,6,141,0,210,173,21,6,141,2,210,173,22,6,141,4,210,173,35,6,
240,6,173,31,6,141,6,210
262 DATA 162,2,189,32,6,240,46,188,36,6,240,41,48,15,254,20,6,136,208,250,1
89,20,6,201,200,144,26,176,13
263 DATA 222,20,6,200,208,250,189,20,6,201,32,176,8,169,0,157,20,6,157,36,6
,157,32,6,202,16,202
264 DATA 173,35,6,240,60,174,39,6,173,10,6,208,19,173,40,6,141,10,6,173,41,
6,208,5,206,23,6
265 DATA 16,3,238,23,6,206,31,6,206,10,6,173,31,6,201,32,176,17,169,120,141
```

(listing continued on page 189)

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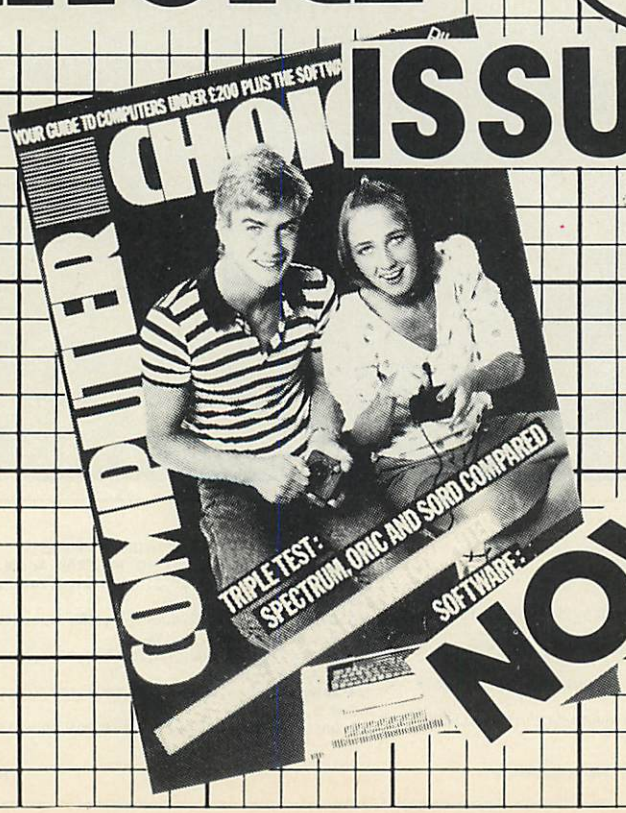
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OUT NOV 9th

(listing continued from page 187)

```
,23,6,169,224,141,31,6
266 DATA 169,0,141,35,6,240,3,202,16,199
267 DATA 173,42,6,208,31,173,15,208,240,26,162,0,74,176,5,232,224,4,208,248
,169,0,141,35,6,157,32,6,157,20,6
268 DATA 169,1,141,42,6,173,43,6,240,36,238,31,6,173,31,6,201,224,144,26,14
1,30,208,169,120
269 DATA 141,23,6,169,224,141,31,6,169,4,141,19,6,169,0,141,42,6,141,43,6
270 DATA 24,173,11,6,105,4,133,204,162,0,134,207,160,0,132,203,189,20,6,157
,0,208,189,12,6,221,16,6,208,8,189,28,6
280 DATA 221,24,6,240,69,189,16,6,157,12,6,189,28,6,157,24,6,165,203,221,28
,6,240,10,169,0,145,203,230,203,240,42
290 DATA 208,239,189,16,6,170,189,48,6,133,205,189,49,6,133,206,177,205,240
,14,145,203,230,205,208,2
300 DATA 230,206,230,203,240,10,208,238,169,0,145,203,230,203,208,250,230,2
04,166,207,232,134,207,224,4,144,154
302 DATA 76,98,228
350 REM * PAGE 6 - INSERT VBI ROUTINE *
360 FOR I=1536 TO 1545:READ A:POKE I,A:NEXT I
370 DATA 104,160,0,162,0,169,7,76,92,228
380 A=ADR(VB$):B=INT(A/256):C=A-256*B:POKE 1538,C:POKE 1540,B
400 GRAPHICS 17:DIM N$(3)
430 GOSUB 1800:DIM T(NP)
500 REM * PLAYER MISSILE SETUP *
510 A=PEEK(RAMTOP)-16:POKE PMBASE,A:POKE PMHI,A
560 REM ** IMAGE 14 BIRD FALL **
562 DIM BFALL$(11):FOR I=1 TO 11:READ A:BFALL$(I,I)=CHR$(A):NEXT I:BFL=ADR(
BFALL$):POKE IMGPNT+15,INT(BFL/256)
564 POKE IMGPNT+14,BFL-256*PEEK(IMGPNT+15)
566 DATA 68,68,68,40,40,56,56,16,16,0
570 REM ** IMAGE 12 BIRD SPLAT **
572 DIM BOOM3$(11):FOR I=1 TO 11:READ A:BOOM3$(I,I)=CHR$(A):NEXT I:BM3=ADR(
BOOM3$):POKE IMGPNT+13,INT(BM3/256)
574 POKE IMGPNT+12,BM3-256*PEEK(IMGPNT+13)
576 DATA 16,40,146,214,124,124,56,56,16,40,0
580 REM ** IMAGE 10 BALLOON BURST **
582 DIM BOOM2$(14):FOR I=1 TO 14:READ A:BOOM2$(I,I)=CHR$(A):NEXT I:BM2=ADR(
BOOM2$):POKE IMGPNT+11,INT(BM2/256)
584 POKE IMGPNT+10,BM2-256*PEEK(IMGPNT+11)
586 DATA 8,40,52,84,74,42,33,17,84,76,42,50,16,0
590 REM ** IMAGE 8 BIRD **
592 DIM BIRD$(9):FOR I=1 TO 9:READ A:BIRD$(I,I)=CHR$(A):NEXT I:BRD=ADR(BIRD
$):POKE IMGPNT+9,INT(BRD/256)
594 POKE IMGPNT+8,BRD-256*PEEK(IMGPNT+9)
596 DATA 192,96,112,58,63,126,60,24,0
600 REM ** IMAGE 6 RAIN **
610 DIM RAIN$(10):FOR I=1 TO 10:READ A:RAIN$(I,I)=CHR$(A):NEXT I:RAI=ADR(RA
IN$):POKE IMGPNT+7,INT(RAI/256)
612 POKE IMGPNT+6,RAI-256*PEEK(IMGPNT+7)
614 DATA 32,4,8,66,32,133,32,8,68,0
620 REM ** IMAGE 4 DART **
624 DIM DART$(9):FOR I=1 TO 9:READ A:DART$(I,I)=CHR$(A):NEXT I:DAR=ADR(DART
$):POKE IMGPNT+5,INT(DAR/256)
625 POKE IMGPNT+4,DAR-256*PEEK(IMGPNT+5)
626 DATA 16,16,16,16,16,56,56,40,0
628 REM ** IMAGE 2 **
630 DIM BALL$(11):FOR I=1 TO 11:READ A:BALL$(I,I)=CHR$(A):NEXT I:BAL=ADR(BA
LL$):POKE IMGPNT+3,INT(BAL/256)
632 POKE IMGPNT+2,BAL-256*PEEK(IMGPNT+3)
640 DATA 36,24,52,122,126,126,126,126,60,24,0
642 REM ** IMAGE 0 **
645 DIM Z$(1):Z$=CHR$(0):ZERO=ADR(Z$):POKE IMGPNT+1,INT(ZERO/256):POKE IMGP
NT,ZERO-256*PEEK(IMGPNT+1)
649 REM ** INIT. IMAGES, HOR. & VERT. POS. **
650 FOR I=1552 TO 1567:READ A:POKE I,A:NEXT I
660 DATA 2,2,2,4,0,0,0,120,0,0,0,0,50,90,130,230
669 REM ** PM GRAPHICS - COLORS **
670 POKE SDMCTL,62:POKE GRACTL,3
695 POKE PCOLR0,38:POKE PCOLR1,56:POKE PCOLR2,70:POKE PCOLR3,86
700 A=USR(1536)
720 RESTORE 725:DIM MPH$(5),SPD$(8):FOR I=1 TO 5:READ A:MPH$(I,I)=CHR$(A):N
EXT I
722 FOR I=1 TO 8:READ A:SPD$(I,I)=CHR$(A):NEXT I:POKE FLAG3,0:POKE FLAG4,0:
POKE FLAG5,0
725 DATA 3,6,9,14,20,254,1,253,2,251,3,250,4
726 FOR I=1 TO NP:T(I)=0:NEXT I:PLYR=0:GOSUB 1400
728 POKE SPEED3,DSPD:SHOTS=AMMO:GOTO 732
729 REM ** MAIN LOOP STARTS HERE **
730 GOSUB 1600:POKE 77,0:SOUND 3,0,0,0:GOSUB 1700:SHOTS=AMMO
732 ? #6;CHR$(125):POSITION 1,0:? #6;"XXXXXXXXXXXXXXXXX ":REM X'S IN INVER
SE
734 SX=3:SY=19:FOR I=1 TO SHOTS:GOSUB 1100:? #6;"*";:NEXT I:SX=3:SY=19
740 R0=RND(0)*DLY:R1=RND(0)*DLY:R2=RND(0)*DLY
742 T(PLYR)=T(PLYR)+TOT:TOT=0
756 POSITION 4,18:? #6;"shots":POSITION 13,18:? #6;"wind":POSITION 12,22:?
#6;"score"
762 PLYR=PLYR+1:IF PLYR>NP THEN PLYR=1:ROUND=ROUND+1:GOSUB 1400:IF ROUND>NR
 THEN 1000
764 POSITION 12,19:IF R8=0 THEN FOR I=1 TO 6-R9:? #6;"<";:NEXT I
766 IF R8=1 THEN FOR I=1 TO 6-R9:? #6;">";:NEXT I
780 POSITION 2,5:? #6;"PULL STICK TO GO"
782 POSITION 12,21:? #6;T(PLYR)
784 FOR J=1 TO 30:NEXT J:POSITION 3,23:? #6;"                    "
786 FOR J=1 TO 30:NEXT J:POSITION 11,23:? #6;"plyr #";PLYR:POSITION 3,23:?
#6;"rnd #";ROUND
788 IF STICK(0)<>13 THEN 784
790 POSITION 2,5:? #6;"                    "
800 IF SHOTS=0 THEN 830
810 IF STRIG(0)=0 AND PEEK(FLAG3)=0 AND PEEK(FLAG4)=0 THEN POKE FLAG3,1:SHO
TS=SHOTS-1:GOSUB 1100:? #6;" ";
820 IF PEEK(FLAG3)=1 THEN POKE AUDC4,168
830 IF PEEK(FLAG3)=0 THEN POKE AUDC4,0
835 R=INT(RND(0)*DIF)+1:SP=ASC(SPD$(R))
840 IF PEEK(FLAG0)=0 THEN R0=R0-1:POKE AUDC1,0
842 IF R0<0 THEN R0=RND(0)*DLY:POKE FLAG0,1:POKE SPEED0,SP:POKE IMAGE0,2:E0
=0:IF RND(0)<BPR THEN GOSUB 1300
844 IF PEEK(FLAG0)=1 THEN POKE AUDC1,162
850 IF PEEK(FLAG1)=0 THEN R1=R1-1:POKE AUDC2,0
852 IF R1<0 THEN R1=RND(0)*DLY:POKE FLAG1,1:POKE SPEED1,SP:POKE IMAGE1,2:E1
=0:IF RND(0)<BPR THEN GOSUB 1310
854 IF PEEK(FLAG1)=1 THEN POKE AUDC2,162
860 IF PEEK(FLAG2)=0 THEN R2=R2-1:POKE AUDC3,0
862 IF R2<0 THEN R2=RND(0)*DLY:POKE FLAG2,1:POKE SPEED2,SP:POKE IMAGE2,2:E2
=0:IF RND(0)<BPR THEN GOSUB 1320
864 IF PEEK(FLAG2)=1 THEN POKE AUDC3,162
870 IF PEEK(FLAG4)=1 AND PEEK(FLAG5)=0 THEN GOSUB 1500:POKE IMAGE3,6:POKE F
LAG5,1
880 IF PEEK(FLAG5)=1 THEN SOUND 3,PEEK(VPOS3),10,8:IF FLAG6=1 THEN POKE IMA
GE3,14
890 IF PEEK(FLAG5)=0 THEN POKE IMAGE3,4
900 IF SHOTS=0 THEN PTIM=0:TIME=WAIT:GOTO 730
910 TIME=TIME-1:IF TIME<0 THEN TIME=WAIT:GOSUB 1200:IF PTIM>18 THEN PTIM=0:
GOTO 730
920 GOTO 800
999 REM ** FINAL SCORES **
1000 ? #6;CHR$(125):POSITION 3,3:? #6;"final scores":X=3:Y=5:FOR I=1 TO NP:
POSITION X,Y
1005 ? #6;"PLYR # ";I;"=";T(I):Y=Y+1:NEXT I
1010 GOTO 1010
1099 REM ** POS. FOR PRINTING '*' **
1100 SX=SX+1:IF SX=9 THEN SX=4:SY=SY+1
1110 POSITION SX,SY:RETURN
1199 REM ** POS. FOR PRINTING 'x' **
1200 PTIM=PTIM+1:POSITION PTIM,0:? #6;"x";:RETURN
1299 REM ** CHANGE TO A BIRD SUBR. **
1300 POKE IMAGE0,8:POKE SPEED0,1:E0=1:RETURN
1310 POKE IMAGE1,8:POKE SPEED1,1:E1=1:RETURN
1320 POKE IMAGE2,8:POKE SPEED2,1:E2=1:RETURN
1399 REM ** WIND SPEED AND DIR SUBR. **
1400 R9=INT(RND(0)*5+1):MPH=ASC(MPH$(R9)):POKE WIND,MPH:R8=INT(RND(0)*2):PO
KE DIR,R8:RETURN
1499 REM ** HIT BIRD OR BALLOON SUBR. **
1500 PHIT=PEEK(P3PL):IF (E0=0 AND E1=0) AND E2=0 THEN GOTO 1508
1502 IF (PHIT=1 AND E0=0) OR (PHIT=2 AND E1=0) OR (PHIT=4 AND E2=0) THEN 15
08
1504 FOR I=1 TO 3:POKE IMAGE3,12:SOUND 3,10*I+10,10,10:FOR J=1 TO 3:NEXT J:
POKE IMAGE3,0
1506 FOR J=1 TO 3:NEXT J:NEXT I:FLAG6=1:GOTO 1514
1508 H3=PEEK(HPOS3):RESTORE 1530:FOR I=1 TO 3:READ M,X:POKE HPOS3,H3-X:POKE
 SIZEP3,M:POKE IMAGE3,10
1510 SOUND 3,100-10*I,12,10:POKE 1555,0:FOR J=1 TO 30:NEXT J:NEXT I:POKE 53
259,0:FLAG6=0:POKE 1559,H3
1514 IF PHIT=1 AND E0=1 THEN E0=0:TOT=TOT-60
1516 IF PHIT=2 AND E1=1 THEN E1=0:TOT=TOT-40
1518 IF PHIT=4 AND E2=1 THEN E2=0:TOT=TOT-20
1520 IF PHIT=1 AND E0=0 THEN TOT=TOT+30
1522 IF PHIT=2 AND E1=0 THEN TOT=TOT+20
1524 IF PHIT=4 AND E2=0 THEN TOT=TOT+10
1526 POSITION 12,21:? #6;T(PLYR)+TOT;"  "
1528 RETURN
1530 DATA 0,0,1,8,3,16
1599 REM ** DART TO INIT. POS. **
1600 POKE FLAG3,0:POKE IMAGE3,4:POKE HPOS3,120:POKE VPOS3,230:FLAG6=0:RETUR
N
1699 REM ** ROUND OVER SUBR. **
1700 FOR I=1 TO 10:FOR J=1 TO 30:NEXT J:POSITION 5,6:IF SHOTS=0 THEN ? #6;"
out of shots":GOTO 1720
1710 ? #6;"out of time  "
1715 REM ** WORDS IN QUOTES IN 1700/10IN INVERSE
1720 POSITION 12,21:? #6;T(PLYR)+TOT:FOR J=1 TO 30:NEXT J:POSITION 5,6:? #6
;"          "
1730 POSITION 12,21:? #6;"     ":NEXT I:RETURN
1799 REM ** ENTER PARAMETERS SUBR. **
1800 ? #6;CHR$(125):POSITION 3,3:? #6;"PLAYING VALUES":POSITION 3,5:? #6;"e
nter one #"
1805 REM ** PLAYING VALUES IN INVERSE
1810 POSITION 3,7:? #6;"(1)# SHOTS =";AMMO:POSITION 3,8:? #6;"(2)DART SP.="
;DSPD
1820 POSITION 3,9:? #6;"(3)BAL. SP.=";DIF:POSITION 3,10:? #6;"(4)BAL. DLY="
;DLY
1830 POSITION 3,11:? #6;"(5)RND TIME=";WAIT:POSITION 3,12:? #6;"(6)# ROUNDS
=";NR
1840 POSITION 3,13:? #6;"(7)# PLYRS =";NP
1842 POSITION 3,14:? #6;"(8)BIRDS   =";BPR
1845 POSITION 3,15:? #6;"(9) NO CHANGES"
1850 GET #1,A:IF A<49 OR A>57 THEN 1850
1855 TRAP 1800
1860 ? #6;CHR$(125):POSITION 3,6:K=A-48:GOSUB 1900+K*10
1870 IF K=9 THEN RETURN
1880 GOTO 1800
1910 ? #6;"# SHOTS = ";AMMO:POSITION 6,10:? #6;"(1 TO 20)":GOSUB 1991:AMMO=
A:RETURN
1920 ? #6;"DART SPEED =";DSPD:POSITION 3,10:? #6;"1(SLOW)-20(FAST)":GOSUB 1
991:DSPD=A:RETURN
1930 ? #6;"BAL. SPEED =";DIF:POSITION 3,10:? #6;"1(SLOW)-8(FAST)":GOSUB 199
1:DIF=A:RETURN
1940 ? #6;"BAL. DELAY =";DLY:POSITION 2,10:? #6;"1(SHORT)-50(LONG)":GOSUB 1
991:DLY=A:RETURN
1950 ? #6;"RND TIME =";WAIT:POSITION 3,10:? #6;"5(FAST)-30(SLOW)":GOSUB 199
1:WAIT=A:RETURN
1960 ? #6;"# ROUNDS =";NR:POSITION 4,10:? #6;"(1-WHATEVER)":GOSUB 1991:NR=A
:RETURN
1970 ? #6;"# PLAYERS = ";NP:POSITION 5,10:? #6;"(1 OR MORE)":GOSUB 1991:NP=
A:RETURN
1980 ? #6;"BIRD PROB. = ";BPR:POSITION 5,10:? #6;"(0.1 TO 0.9)":GOSUB 1991:
BPR=A:RETURN
1990 RETURN
1991 N$="":POSITION 3,8:? #6;"INPUT NEW VALUE ";:POSITION 8,12
1992 GET #1,A:? #6;CHR$(A);:IF A=155 THEN A=VAL(N$):RETURN
1994 N$(LEN(N$)+1)=CHR$(A):GOTO 1992
NOTES:
LINE 784 HAS 15 BLANK SPACES IN QUOTES
LINE 790 HAS 16 SPACES
LINE 1720 HAS 13 SPACES
LINE 1730 HAS 5 SPACES
IN LINES 764 AND 766 TYPE < AND >
INSIDE QUOTES IN INVERSE VIDEO
```

HISOFT PASCAL

Hisoft Pascal 4 is a very fast and powerful microcomputer Pascal compiler that is the result of three years development work. The compiler conforms very closely to Stanard Pascal as described in the Pascal User Manual and Report (Jensen/Wirth) and produces Z80 object code directly in one pass; no P-codes to be subsequently interpreted. HP4 is also small (not more than 19K including runtime routines and tables) but this does not imply any lack of power — the compiler and runtimes were written in Z80 assembler language and a great deal of time was spent on increasing the speed and decreasing the size of the critical routines.

We have designed HP4 to be simple to use, very fast, close to Standard Pascal (with extensions) and inexpensive. Thus we see it as being an attractive package in the educational field (from teaching yourself at home to teaching students at university level) and in the area of system development. To this end Hisoft Pascal 4 is available in both cassette tape and diskette versions for a wide range of Z80 machines. The tape and disk versions are virtually identical except that the cassette version does not support FILEs, instead the user is given the ability to store and retrieve any variable to and from tape. The tape version (HP4T) is organised in a manner that makes it very easy to adapt to most Z80 systems and we supply details on how to do this in our HP4T Alteration Guide available separately.

In addition to our Pascal we also have available DEVPAC — a Z80 development package which includes a fast and powerful conditional assembler, a labelling disassembler, a debugger with single-step facility (even in ROM) and (on diskette) an extended screen editor. DEVPAC is a highly professional suite of programs which will greatly facilitate your software development.

*****STOP PRESS*****

Hisoft Pascal now available for the SHARP MZ700!
Pascal for the ZX SPECTRUM now includes FREE Logo-style Turtle Graphics!
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Prices:
HISOFT PASCAL 4 tape version (SHARP MZ80A/K/B, MZ700, NEWBRAIN etc.) **£40.25**
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BBC

Over the next few months John Dawson will take you through Heartsop, a hospital simulation program he is formulating for the BBC Micro. This month he explains the aim of the game and the thinking behind its design.

SOME PEOPLE can hold the whole of a plan for a game in their head while they write the program. I am not so lucky and even when I have written down my plan it takes a great deal of trial and error on a computer to make it work smoothly.

Heartstop is a game that I intend to write for the BBC Micro. First, the top-down description of the game.

Slagthorpe Memorial Hospital is a district general hospital with a casualty department, and medical and surgical wards. The player is expected to act as a weekend relief doctor from 18.00 hours on Friday evening until the regular Resident Medical Officer returns at 09.00 Monday morning. The aim of the game is to keep the patients already in the hospital alive over the weekend, deal with unexpected emergencies and newly-admitted patients.

The game is unlikely to include any "fast-action, high-resolution action-packed graphics sequences", although it might be nice to insert something of the sort when the doctor is dealing with a cardiac arrest or some similar emergency.

Success in the game is measured by the state of the patients at the end of the weekend. You fail if you call in the consultant for some trivial matter on Sunday afternoon or at two o'clock in the morning.

Various other people will have an impact on the doctor as he or she works feverishly — one of the patients has just returned from a Mediterranean holiday with symptoms a bit like typhoid — to cure the sick of Slagthorpe.

The bleep normally carried by a Resident Medical Officer can be used to generate random messages from the doctor's boy/girl friend, bank manager, hospital administrator, pharmacist, casualty sister, or ward sister.

The player must be able to put off answering the bleep if he or she is in the middle of some urgent treatment. However, leaving a message unanswered for too long should be a prelude to a deteriorating situation.

Test modules separately

That seems like a reasonably interesting idea for a game. But how will you or I translate that into lines of Basic. The easiest way is to keep that top-down approach in your mind and then work bottom-up until the two meet.

Bottom-up means building subroutines and procedures that will carry out a part of the program's function. You can test each of these modules separately and then combine them to create a more complex program. This is like building a pyramid — you need an idea of the final shape and you must know the location. After that you lay out the ground and start to move a lot of stone blocks, piling one on top of another until you get it right.

One problem in trying to base a game on real life is the complexity of almost any human activity. The range of actions that may be carried out by a junior doctor in an NHS hospital is way beyond the capacity of a microcomputer to model.

In the same sense the flight simulator programs available for the Spectrum and Apple computers cannot show more than five or ten per cent of the instruments on the flight deck of a Jumbo 747 aircraft. The program cannot simulate a fire in the port outer engine because there are no engine temperature or oil pressure gauges on the simulated displays. That does not mean that the program cannot provide a good game; simply that it is a simplified model or an abstraction of real life.

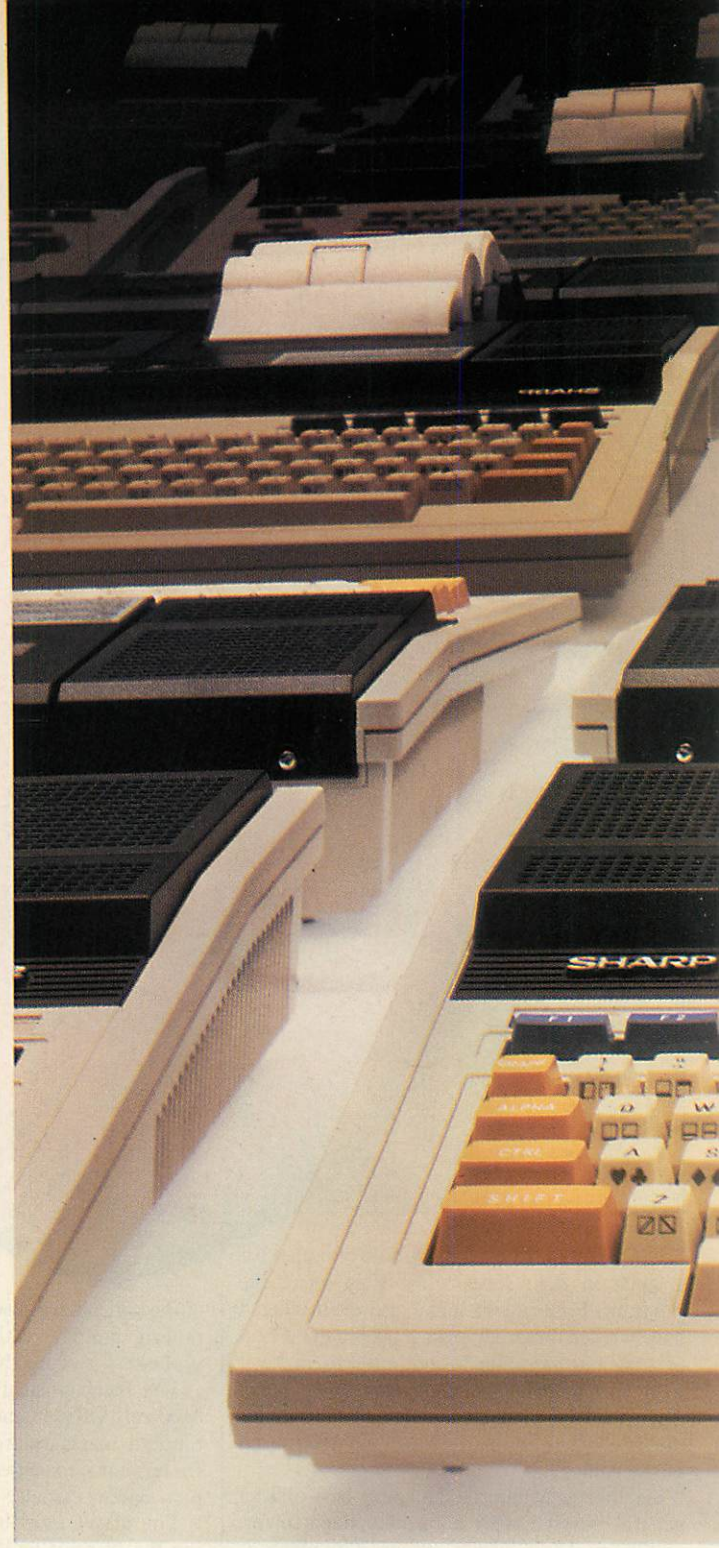
Just like drawing a good cartoon, you will have to find the parts of the situation you want to model that best describe the process. In the case of the doctor and Heartstop, the first list will be the actions that the player can take to treat the patients:

1. Examine the patient
2. Order an ECG examination
3. Order an X-ray examination
4. Make a diagnosis
5. Talk to the relatives
6. Prescribe one or more drugs
7. Carry out an operation
8. Discharge the patient — cured
9. Modify the treatment/diagnosis
10. Sign a death certificate

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(continued on page 197)

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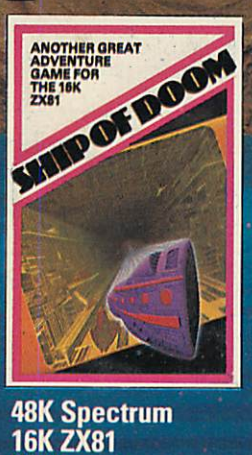
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D



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(continued from page 193)

1. Antibiotics — Penicillin
   — Streptomycin
2. Pain relievers — Morphine
   — Paracetamol
   — Aspirin
3. Sedative — Valium
4. Heart drugs — Digoxin
   — Atropine
   — Lignocaine

The bottom-up approach starts from very small beginnings. Three months ago I wrote a small program that displayed a normal ECG tracing in the top right-hand corner of the BBC screen. That was part of the "investigation" action that the doctor can carry out. I have not programmed the X-ray routines yet but clearly the doctor will need a bleep so that he can be contacted when a new case arrives in Casualty and the player will need a plan of the hospital showing the position of the wards, doctor's duty room, Casualty department and so on. This will be important because it takes some time to run or walk from one place to another and planning where to go when you have a dodgy patient on the ward can be important.

The program will need a 24-hour clock displayed on the screen almost all the time and the clock will have to be updated both in real time during some parts of the game and directly by the program if, for example, the doctor manages to get an undisturbed night's sleep — slim chance!

Heartstop, to its current level of completion, is listed in figure 1. The ECG plotting routines are omitted for the sake of saving space — they were printed in the August issue of *Your Computer* and need only the addition of a line — ProcQ — at the end of the Procecg routine. The program is still at the stage where I am writing the input and output routines to present information to the player.

As far as possible I have used procedures to carry out certain tasks; this is for two important reasons. First, procedures execute more quickly than subroutines in BBC Basic. Both the Goto and Gosub instructions make the Basic interpreter search the program from the beginning to find the line number.

The interpreter has to compare line numbers one at a time until either the search succeeds, or a line number is found that is larger than the target. This is very longwinded in comparison to a Proc instruction which stores the address of the procedure the first time it is used.

Use macro-instructions

The second call to the procedure is faster as the program has only to check the existence of the pointer and then jump directly to the Basic instructions that make up the procedure. Second, you can use procedures like macro-instructions in assembly language, passing numbers, strings and other variables into the procedure without difficulty.

Prochosplan which is defined in lines 1000 to 1310 illustrates the value of procedures. Procward draws a standard rectangle, lines 1570 to 1630; where K% is the position of the ward or box on the Y axis, that is up and down the screen. Corr% is set at the beginning of the program to the right hand side of the corridor and Corl% represents the left-hand side.

Procward1 sets G%, the X axis position, to the right side and Procward2 sets G% to the left side of the corridor minus the length of the ward. The ward is drawn by inverting the background colour — Plot 6 — and consequently the corridor walls, drawn before the wards in lines 1050 to 1100, are reversed once again back to the background colour where the ward meets the corridor.

Lines 1200 and 1240 are pleasing. Rather than program each caption for the wards separately I used a loop which steps from one ward to the next to print the word "ward". In addition, the number of the ward is generated automatically by the rest of the line.

Prochosplan shows how you can construct shapes and regular graphic displays using some simple procedures. I find it easier to stay with one type of command and that is why I have used Plot 4 instead of the Move instruction; the two have an identical effect.

Line 1960 sets up a text window for the display of possible actions by the doctor because that uses much less memory than spacing all the text lines in from the left hand margin. It is much easier to set the left-hand margin five spaces in for the whole screen than it is to remember to type all the spaces or a Tab instruction for each line.

ProcQ simply waits until you press the Return key, meanwhile displaying the time. Procdisplaytime is a 24-hour clock taken from the BBC User Guide with some modifications. Lines 1830 and .1840 stop the display being updated more than once a second. Line 1850 is supposed to increment the day pointer at midnight but will need further work, it can be omitted for the present.

Small beginnings indeed. Next month I shall write about handling the bleep messages, extending the range of ECG results and creating patients to populate the hospital.

Figure 1.

```
  10 CORR% = 300 : CORL% = 250
  20 *KEY0 MODE 7 |M |N LIST |M
  30 REM "HEARTSTOP"
  40 REM Started 12 June 1983
  50 REM A game by John Dawson
  60
  70 PROCinit
  80 MODE 4
  90 PROChosplan
 100 PROCstatus1
 110 PROCQ
 120 VDU26: CLS
 130
 140 REPEAT : REM Main Command Loop
 150   VDU19,0,0,0,0,0
 160   VDU19,1,3,0,0,0
 170   comm = INKEY(10)
 180   IF comm = -1 THEN PROChousekeepe
r
 190   comm$ = CHR$(comm)
 200   IF comm$ = "E" THEN PROCecg
 210   IF comm$ = "D" THEN PROCdoctor
 220   IF comm$ = "P" THEN PROChosplan:
PROCQ: VDU26: CLS
 230   UNTIL comm$ = "Q"
 240 MODE 7
 250 END
 260
 270 DEF PROChousekeeper
 280 VDU26
 290 PROCdisplaytime (24,1)
 300 ENDPROC
 310
 320 DEF PROCecg
 330
 340 REM See previous Your Computer
 350 REM for PROCecg and PROCecgplot
 360 REM listing.  Minor changes only
 370 REM are necessary to make
 380 REM the procedures compatible.
 390
 400 REM ..........................
 410
 420 CLG
 430 VDU 5
 440 VDU 19,0,0,0,0,0
 450 VDU 19,1,2,0,0,0
 460 MOVE 500,1000 : MOVE 1250,1000
 470 PLOT 85,500,660
 480 PLOT 85,1250,660
 490 MOVE 500,800
 500 PROCecgplot
 510 MOVE 500,600
 520 PRINT "ECG shows ";res$
 530 VDU4
 540 PROCQ
 550 VDU26
 560 CLS
 570 ENDPROC
 580
 590 REM ..........................
 600
 610 DEF PROCinit
 620 DIM Y(30)
 630 DIM Date$(3)
 640 ON ERROR GOTO 950
 650 TIME = 18 * 360000
 660 Date$(0) = "Friday"
 670 Date$(1) = "Saturday"
 680 Date$(2) = "Sunday"
 690 Date$(3) = "Monday"
 700 PTS% = RND(6)+1
 710 AA% = 0: TI% = 0
 720 ENDPROC
 730
 740 REM ..........................
 750
 760 DEF PROCecgplot
 770 res$ = "normal rhythm"
 780 size = 15
 790 LOCAL  X,Y,xpos,ybaseline
 800 xpos = 500
 810 ybaseline = 800
 820 REPEAT
 830   FOR X = 1 TO 120 STEP 5
 840     READ Y
 850     PLOT 6,(xpos+X),(ybaseline + (
size * (Y)))
 860     NEXT X
 870   xpos = xpos+X
 880   RESTORE
 890   UNTIL xpos > 1150
 900 DATA 0,0,0.7,1.4,1.1,0,0,-1,16,-6,0,
0,1,1.5,3,2,1.5,0.5,0,0,0,0,0,0,0,0,0,0
 910 ENDPROC
 920
 930 REM ..........................
 940
 950 MODE 7 : REM Error handling
 960 REPORT
 970 PRINT ERL
 980 END
 990
1000 DEF PROChosplan
1010 CLS
1020 VDU24,0;0;600;1023;
1030 VDU19,0,2,0,0,0
1040 VDU19,1,2,0,0,0
1050 PROCcorr
1060 PROCward1 (700)
1070 PROCward1 (500)
1080 PROCward1 (300)
1090 PROCward2 (600)
1100 PROCward2 (400)
1110 PROCresid
1120 PLOT4,600,1023
1130 PLOT6,600,0
1140 VDU19,1,1,0,0,0
1150 VDU5
1160 MOVE10,900
1170 PRINT"Hospital plan view";
1180 FOR L = 350 TO 250 STEP 200
1190   MOVE CORR%,L
1200   PRINT"Ward ";INT(L/100-2)
1210   NEXT L
1220 FOR L = 450 TO 650 STEP 200
1230   MOVE CORL%-180,L
1240   PRINT"Ward ";INT(L/100-2)
1250   NEXT L
1260 MOVE410,160
1270 PRINT"Duty"
1280 MOVE410,120
1290 PRINT"room"
1300 VDU4
1310 ENDPROC
1320
1330 DEF PROCstatus1
1340 VDU28,20,31,39,0
1350 VDU4
1360 VDU31,0,3
1370 PRINT "   SLAGTHORPE"
1380 PRINT "    MEMORIAL"
1390 PRINT "    HOSPITAL"
1400 VDU31,0,10
1410 PRINT"Patients   ";PTS%
1420 PRINT:PRINT"Beds free  ";(20-PTS%)

1430 VDU31,0,29
1440 PRINT"Press (Return)"
1450 PRINT"to continue";
1460 PROCQ
1470 VDU26
1480 CLS
1490 ENDPROC
1500
1510 DEF PROCcorr
1520 PLOT 4,CORL%,850:PLOT 6,CORL%,280
1530 PLOT 6,CORR%,280:PLOT 6,CORR%,850
1540 PLOT 6,CORL%,850
1550 ENDPROC
1560
1570 DEF PROCward (K%)
1580 PLOT 4,G%,K%
1590 PLOT 6,G%+200,K%
1600 PLOT 6,G%+200,K%+80
1610 PLOT 6,G%,K%+80
1620 PLOT 6,G%,K%
1630 ENDPROC
1640
1650 DEF PROCward1 (K%)
1660 G% = CORR%
1670 PROCward (K%)
1680 ENDPROC
1690
1700 DEF PROCward2 (L%)
1710 G% = CORL%-200
1720 PROCward (L%)
1730 ENDPROC
1740
1750 DEF PROCresid
1760 PLOT 4,400,70: PLOT 6,550,70
1770 PLOT 6,550,180
1780 PLOT 6,400,180
1790 PLOT 6,400,70
1800 ENDPROC
1810
1820 DEF PROCdisplaytime (XX%,YY%)
1830 IFTI% > TIME THEN ENDPROC
1840 TI% = TIME+100
1850  IF*(TIME DIV 360000) > 24 THEN AA
% = AA%+1
1860 Sec = (TIME DIV 100) MOD 60
1870 Min = (TIME DIV 6000) MOD 60
1880 Hrs = (TIME DIV 360000) MOD 24
1890 PRINT TAB(XX%,YY%);"Time: "
1900 PRINT TAB(XX%,YY%+1);Date$(AA%);",
";Hrs;":";Min;":";Sec
1910 ENDPROC
1920
1930 DEF PROCdoctor
1940 VDU19,0,6,0,0,0
1950 VDU19,1,1,0,0,0
1960 VDU28,5,31,39,0
1970 VDU30
1980 CLS
1990 PRINT TAB(0,5) "You may carry out
any of the "
2000 PRINT"following actions:"
2010 PRINTTAB(0,8) "1  Move to a new lo
cation"
2020 PRINT"2  Talk to & examine a patie
nt"
2030 PRINT"3  X-ray a patient"
2040 PRINT"4  Order an ECG"
2050 PRINT"5  Prescribe drugs"
2060 PRINT"6  Make a diagnosis"
2065 PRINT"7  Talk to the relatives"
2070 PRINT"8  Send a patient home"
2080 PRINT"9  Revise your diagnosis"
2090 PRINT"10 Change the treatment"
2100 PRINT"11 Sign a death certificate"

2110 INPUTTAB(0,20) "Select 1 - 10  " I
2120 CLS
2130 ENDPROC
2140
2150 DEF PROCQ
2160 REPEAT QQ = INKEY(-74)
2170   PROCdisplaytime (0,23)
2180   UNTIL QQ
2190 ENDPROC
```

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Access

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(continued from page 208)

up several things; the user-defined graphics for the man, the dragon and the exit arrow, Robert Newman's excellent machine-code routine to move them round the screen at the pixel level, as well as two machine-code sound routines. If the program detects a difference between the checksum and the cumulative total of all the data values read, check your punching very carefully against listing 1 and correct it. When the program has run successfully, it will Save the block of 605 bytes to cassette with the name

DRAGONCODE.

Now punch in the program shown in listing 2 and save it to another cassette in command mode by typing

SAVE "DRAGON" LINE 130

When the program has been successfully saved, load the block of code which was created by the first program and Save it on the same cassette as "DRAGON" and immediately after it. This can be done in command mode as follows:

LOAD " " CODE
SAVE "DRAGONCODE" CODE 31951,605

You should now be able to rewind the cassette, type

LOAD "DRAGON"

and the program will load and immediately run.

Some notes on the various sections of the program may be helpful, as I have not used any Rem statements in an effort to conserve space:

Lines 80 to 120 are commonly-used subroutines
Lines 170 to 450 are the main program loop during execution
Lines 1000 to 1220 decide which direction the dragon is going to move
Lines 4000 to 4350 generate the maze at the start of the game
Lines 8000 to 8520 handle the end of game
Lines 9220 to 9230 are the Basic interface to the machine-code C routine

Note that in line 130 there are several Poke statements; these reset the pointer for the user-defined graphics, and force the machine into cap-lock mode.

How M$ array is used

It may make the program more understandable to explain how the M$ array is used. The first four bytes of each five- byte element are used to store the directions in which one may move in that block of the maze; A * means that the direction is permissible, a space that it is not. The directions are stored in the order right, left, up and down respectively. The fifth byte serves two purposes; when the maze is being generated, an N means that the maze block has not yet been accessed, a Y that it has. After generating the maze, this byte is cleared to zero and then used as a binary count of the number of times the dragon has been in that block.

```
  10 DATA 1,1,2
  20 DATA 13,4,3
  30 DATA -1,2,1
  40 DATA -13,3,4
  50 DATA 64+13*SX,14+13*(13-SY),10,10,H,1
  60 DATA 64+13*X,14+13*(13-Y),10,10,H,4
  70 DATA 248,13+13*(13-WY),8,8,H,7
  80 PRINT AT 1,5; OVER 0;"   ";AT 1,8-LEN STR$ W;W: RETURN
  90 LET W=C-1: GO SUB 80: RESTORE 10+Z: READ INC,P,Q: LET IN=0: GO SUB 100: LET
IN=INC: LET P=Q: GO SUB 100: RETURN
 100 LET M$(K+IN,P)="*": RETURN
 110 DEF FN R(A)=INT(RND*A+1)
 120 RESTORE PTR: FOR M=0 TO 5: READ P: POKE 31951+M,P: NEXT M: RANDOMIZE USR 31
962: RETURN
 130 CLEAR 31950: LOAD "DRAGONCODE" CODE 31951,605: POKE 23675,200: POKE 23676,1
25: POKE 23658,8
 140 DIM M$(169,5): BORDER 4: PAPER 4: CLS : LET XS=5: LET YS=5: LET P$="DRAGON"
: LET YY=40: GO SUB 9220: LET P$="MAZE": LET YY=96: GO SUB 9220: PAUSE 200
 150 BORDER 5: PAPER 5: CLS : GO SUB 4000
 160 LET SCORE=200: POKE 23560,0
 170 LET I=PEEK 23560: IF I()0 THEN LET A$=CHR$ I: POKE 23560,0: GO TO 190
 180 GO TO 170
 190 LET W=K: LET DX=0: LET DY=0
 200 IF A$="P" THEN GO TO 250
 210 IF A$="I" THEN GO TO 320
 220 IF A$="O" THEN GO TO 350
 230 IF A$="Z" THEN GO TO 380
 240 GO TO 450
 250 IF X=13 THEN GO TO 450
 260 IF M$(K,1)()"*" THEN GO TO 410
 270 LET DX=1
 280 LET H=0: LET PTR=60: GO SUB 120: BEEP .01,30: LET H=1: LET X=X+DX: LET Y=Y+
DY: GO SUB 120: LET K=X+13*(Y-1)
 290 IF X=SX AND Y=SY THEN GO TO 8000
 300 IF X=13 AND Y=WY THEN GO TO 8500
 310 GO SUB 1000: GO TO 170
 320 IF X=1 THEN GO TO 450
 330 IF M$(K,2)()"*" THEN GO TO 420
 340 LET DX=-1: GO TO 280
 350 IF Y=1 THEN GO TO 450
 360 IF M$(K,3)()"*" THEN GO TO 430
 370 LET DY=-1: GO TO 280
 380 IF Y=13 THEN GO TO 450
 390 IF M$(K,4)()"*" THEN GO TO 440
 400 LET DY=1: GO TO 280
 410 PLOT 75+13*X,3+13*(13-Y): DRAW 0,12: GO TO 450
 420 PLOT 62+13*X,3+13*(13-Y): DRAW 0,12: GO TO 450
 430 PLOT 62+13*X,16+13*(13-Y): DRAW 12,0: GO TO 450
 440 PLOT 62+13*X,3+13*(13-Y): DRAW 12,0
 450 LET SCORE=SCORE-1: LET W=SCORE: GO SUB 80: RANDOMIZE USR 32174: GO SUB 1000
: GO TO 170
1000 LET W=L: LET DX=0: LET DY=0: LET OK=(CODE M$(L,5))9)
1010 IF X ) SX THEN GO TO 1050
1020 IF Y ) SY THEN GO TO 1110
1030 IF X ( SX THEN GO TO 1150
1040 IF Y ( SY THEN GO TO 1190
1050 IF SX=13 THEN GO TO 1110
1060 IF OK THEN GO TO 1080
1070 IF M$(L,1)()"*" THEN GO TO 1110
1080 LET DX=1
1090 LET H=0: LET PTR=50: GO SUB 120: BEEP .01,10: LET H=1: LET SX=SX+DX: LET SY
=SY+DY: GO SUB 120: LET L=SX+13*(SY-1): LET M$(L,5)=CHR$ (CODE (M$(L,5))+1): IF
X=SX AND Y=SY THEN GO TO 8000
1100 RETURN
1110 IF SY=13 THEN GO TO 1150
1120 IF OK THEN GO TO 1140
1130 IF M$(L,4)()"*" THEN GO TO 1150
1140 LET DY=1: GO TO 1090
1150 IF SX=1 THEN GO TO 1190
1160 IF OK THEN GO TO 1180
1170 IF M$(L,2)()"*" THEN GO TO 1190
1180 LET DX=-1: GO TO 1090
1190 IF SY=1 THEN GO TO 1050
1200 IF OK THEN GO TO 1220
1210 IF M$(L,3)()"*" THEN GO TO 1050
1220 LET DY=-1: GO TO 1090
4000 OVER 0: GO SUB 5000
4010 FOR N=0 TO 169 STEP 13: PLOT N+75,3: DRAW 0,169: PLOT 75,N+3: DRAW 169,0: N
EXT N: PRINT AT 0,0;"BLOCKS  ";AT 1,0;"LEFT:168"
4020 FOR N=1 TO 169: LET M$(N)=C$: NEXT N
4030 RANDOMIZE : LET X=FN R(13): LET Y=FN R(13): LET C=169: OVER 1
4040 IF C=1 THEN OVER 0: PAPER 5: PRINT AT 0,0;G$;AT 1,0;G$: GO TO 4320
4050 LET R=0: LET U=0: LET L=0: LET D=0: LET Z$="": LET K=X+13*(Y-1): LET M$(K,5
)="Y": LET C=C-1
4060 IF X=13 THEN GO TO 4080
4070 LET R=M$(K+1,5)="N": IF R THEN LET Z$=Z$+"0"
4080 IF Y=13 THEN GO TO 4100
4090 LET D=M$(K+13,5)="N": IF D THEN LET Z$=Z$+"1"
4100 IF X=1 THEN GO TO 4120
4110 LET L=M$(K-1,5)="N": IF L THEN LET Z$=Z$+"2"
4120 IF Y=1 THEN GO TO 4140
4130 LET U=M$(K-13,5)="N": IF U THEN LET Z$=Z$+"3"
4140 LET Q=R+D+L+U
4150 IF (Q(3 AND RND*9+1(2) OR Q=0 THEN GO TO 4290
4160 LET Z=10*VAL Z$(INT (RND*LEN Z$)+1): BEEP .01,Z: GO TO 4170+3*Z
4170 PLOT 75+13*X,4+13*(13-Y): DRAW 0,11
4180 LET X=X+1
4190 GO SUB 90: GO TO 4040
4200 PLOT 63+13*X,4+13*(13-Y): DRAW 11,0
4210 LET Y=Y+1
4220 GO TO 4190
4230 PLOT 62+13*X,4+13*(13-Y): DRAW 0,11
4240 LET X=X-1
4250 GO TO 4190
4260 PLOT 63+13*X,16+13*(13-Y): DRAW 11,0
4270 LET Y=Y-1
4280 GO TO 4190
4290 LET X=INT (RND*13)+1: LET Y=INT (RND*13)+1
4300 IF M$(X+13*(Y-1),5)="N" THEN GO TO 4290
4310 LET C=C+1: GO TO 4040
4320 FOR N=1 TO 10: BEEP .05,N: NEXT N: FLASH 1: PRINT AT 10,0;"THE MAZE ";AT 11
,0;"IS READY!": FLASH 0: FOR N=1 TO 169: LET M$(N,5)=CHR$ 0: NEXT N: PRINT AT 10
,0;G$;AT 11,0;G$: GO SUB 5000
4330 LET X=1: LET Y=FN R(13): LET K=X+13*(Y-1): LET PTR=60: LET H=1: GO SUB 120:
 PRINT AT 0,0;"SCORE IS";AT 1,0;"NOW: 200"
4340 OVER 1: LET WY=FN R(13): FOR N=1 TO 4: PLOT 243+N,4+13*(13-WY): DRAW 0,11:
NEXT N: LET PTR=70: PAPER 5: LET H=1: GO SUB 120: PAPER 7: OVER 0
4350 LET SX=13: LET SY=WY: LET L=SX+13*(SY-1): RETURN
5000 PAPER 7: LET C$="    N": LET G$="      "
5010 PRINT AT 0,9;"[redacted]": FOR N=1 TO 20: PRINT AT N,9;"[redacted]": NEXT N: PRINT AT 21,9;"[redacted]": RETURN
8000 RANDOMIZE USR 32148: PAUSE 50
8010 BORDER 6: PAPER 6: CLS : LET XS=1: LET YS=3: LET P$="THE DRAGON GOT YOU !":
 LET YY=10: GO SUB 9220
8020 LET YS=2: LET P$="DO YOU WISH TO :": LET YY=56: GO SUB 9220: LET XX=0
8030 LET P$="1) PLAY AGAIN WITH THE SAME MAZE": LET YY=84: GO SUB 9230: LET P$="
2) PLAY AGAIN WITH A NEW MAZE": LET YY=100: GO SUB 9230
8040 LET P$="3) END THE GAME ?": LET YY=116: GO SUB 9230
8050 LET P$="PLEASE ENTER REQUIRED OPTION NO.": LET YY=160: GO SUB 9230
8060 IF INKEY$="" THEN GO TO 8060
8070 IF INKEY$="1" THEN BORDER 5: PAPER 5: CLS : GO SUB 4320: GO TO 160
8080 IF INKEY$="2" THEN GO TO 150
8090 IF INKEY$="3" THEN CLS : LET P$="THANKS FOR THE GAME !": LET YY=80: GO SUB
9220: STOP
8100 GO TO 8060
8500 BORDER 6: PAPER 6: CLS : LET XS=2: LET YS=2: LET YY=0: LET P$="CONGRATULATI
ONS!": GO SUB 9220
8510 LET P$="YOU WIN - YOUR SCORE WAS "+STR$ SCORE: LET XS=1: LET YY=24: GO SUB
9220
8520 GO TO 8020
9220 LET XX=(256-8*XS*LEN P$)/2
9230 LET I=23306: POKE I,XX: POKE I+1,YY: POKE I+2,XS: POKE I+3,YS: POKE I+4,8:
LET I=I+4: LET W=LEN P$: FOR N=1 TO W: POKE I+N,CODE P$(N): NEXT N: POKE I+W+1,2
55: LET W=USR 32256: RETURN
9997 SAVE "DRAGON" LINE 130
9998 SAVE "DRAGONCODE" CODE 31951,605
```

LISTING 2 - THE MAIN PROGRAM

NOTE :- THE PRINT STRINGS IN LINE 5010 ARE ALL 22 CHARACTERS LONG.
****

Hi-res draw

A Wright,
St Helier,
Jersey.

CBM-64

THE MAIN PURPOSE of this program is to allow you to draw on a high-resolution screen and Save the information to disc or tape.

Line 0 reads the machine-code data in, to clear the high-resolution screen.

Line 11 — Sys 20000 clears the high-resolution screen Sys 20071 changes the colour of the screen.

Lines 10 and 13 initialise the high-resolution screen.

Line 20 — x = 160 y = 100 are the starting point of the drawing.

Line 30 — variable p = Peek the joystick, variable a = Peek the keyboard.

Lines 40 to 92 read the joystick and sets the x and y co-ordinates to the appropriate value.

Line 100 the variables are as follows:

CH = character divided by eight because the characters are eight pixels wide.

RO = the row divided by eight because the row is eight pixels wide.

LN = line on which the pixel will appear.

BY = the actual screen location.

BI = bit identification — i.e., where the pixel will be drawn on the screen.

Line 110 Pokes the appropriate pixel on the screen.

Line 120 — variable a = 4 only if F1 is pushed.

Line 121 — variable a = 5 only if F3 is pushed.

Line 130 loops back to line 30.

Lines 410 to 470 is the data for screen clearing.

(continued on page 215)

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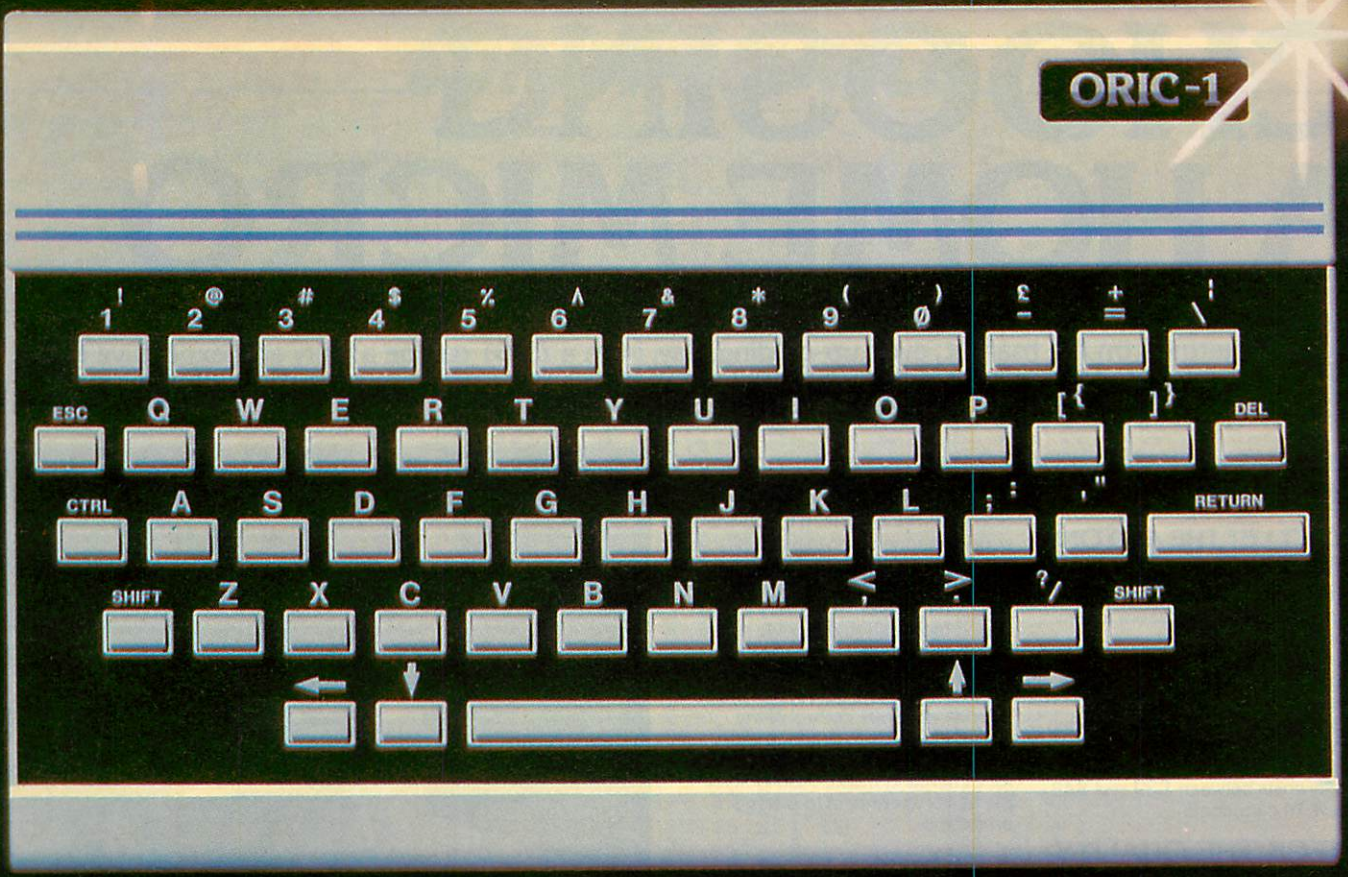
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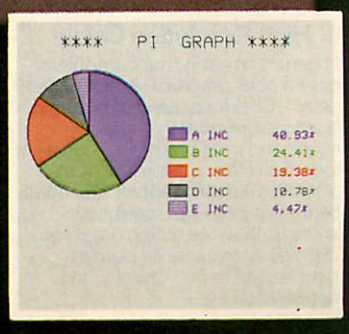
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(continued from page 205)

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You can see stations

From the left window you can see stations, signals and other trackside indicators, while the right window is used to inform you of any errors you have made.

Four keys are used to control the train as follows:

- Function key F1 — Increase power
- Function key F3 — Decrease power
- Function key F5 — Increase braking
- Function key F7 — Decrease braking
- Space-bar — Horn

The power and brake controls operate in the range 0 to 3 and the power cannot be applied until the brake setting is zero.

All signals are of the Four Aspect Colour Light type, and each has a letter superimposed on it indicating its colour so that anyone using a black and white television will still be able to recognise the signal setting. Operation of the signals is according to standard railway practice. There are four different signal indications — red, single yellow, double yellow and green. When a signal shows red, the train must be stopped. Signals showing any other colour may be passed, but the colour gives a warning of the state of the following signals.

Audible warning heard

A single yellow means that the next signal is at red, although it may have changed before it is reached. If it has not changed from red, an audible warning will be heard before the signal is reached and you must reduce speed so that the train can be brought to a halt when the signal appears.

A double yellow indication means that the next signal is at single yellow and a green indication means that the following signal is, at worst, a double yellow. In each case, the signal may have changed for the better before it is reached.

Typical timetable

A typical time-table for the journey for both express and stopping trains is as follows:

Station	Express	Local
Longcar	10.00	10.00
Weston	10.03	—
Redham	10.06	—
Marford	10.09	10.06
Cardale	10.12	—
Newtown	10.15	10.11
Colwood	10.18	—
Halton	10.21	—
Cragbay	10.24	—
Seaport	10.26	10.18

```
1 TT=1:T$="A LOCAL":PRINT"■NIGHT TRAIN":IFRND(1)<.5THENTT=2:T$="AN EXPRE
SS"
2 PRINT"■TONIGHT,YOU ARE       DRIVING "T$
3 PRINT"  TRAIN TO SEAPORT":FORI=1TO3000:NEXT:POKE 36879,254
4 L1=1:E=1:B=3:PRINT"■":S1=4:TI$="095940":N$="LONGCAR":DR=10:D=.02:IC=197
5 MC=38400:MS=7680:V1=36874:V2=36875:V3=36876:WN=36877:V=36878:POKE36879,250
6 DATA1.3,WESTON,0,3.3,REDHAM,.1,5,MARFORD,-.2,7.3,CARDALE,0,9,NEWTOWN,-.3
7 DATA 10.3,COLWOOD,.4,12.3,HALTON,0,14.3,CRAGBAY,-.4,15,SEAPORT,0
8 FORL=2TO17:FORG=2TO9:T=0:GOSUB69:NEXTG,L
9 FORL=2TO17:FORG=12TO19:GOSUB69:NEXTG,L
10 PRINT" ■PWR  BRK"
11 PRINT"■"P;"  ";B:IFB>0THENP=0
12 S=S+P*0.3-B↑2*0.3-S/200-IX:IFS<0THENS=0
13 S$=STR$(INT(S)):IFS<10THENS$=" "+S$
14 PRINT"■MPH■"S$"■"LEFT$(TI$,4)"■"
15 D=D+S*.0002:C=INT(D*10+.5)/10:T1$=RIGHT$(TI$,2):T1=VAL(T1$)
16 IF S>S1*10+4THENGOSUB57
17 A=PEEK(203):IFA=64THEN22
18 IFA=39THENP=P+1:IFP>3THENP=3
19 IFA=47THENP=P-1:IFP<1THENP=0
20 IFA=55THENB=B+1:IFB>3THENB=3
21 IFA=63THENB=B-1:IFB<0THENB=0
22 IFZ=1ANDS=0THENE=1
23 IFGG=1ORS>0THEN25
24 GS=T1+10+INT(X*10):IFGS>59THENGS=GS-60:SG=0:GG=1
25 IFZ=1THEN33
26 IFTT=1THEN29
27 IFC=5.1ORC=9.1THEN29
28 GOTO30
29 IFZ=0ANDE=0THENGOSUB56
30 IFC<DSTHENE=1:GOTO35
31 E=0:T=1:GOSUB71
32 IFHS=0ANDC>.5THENGOSUB58
33 IFC<DS+0.1THEN35
34 T=0:GG=0:GOSUB71:GOTO43
35 IFD<DS+.01THEN37
36 POKE38578,0:POKE7858,19
37 IFD>15.04THEN61
38 IFZ=0THEN43
39 IFS>0THEN41
40 IFT1=GSTHENGOSUB104
41 IFE=0THEN43
42 IFS>3ANDSG=0THENGOSUB59
43 IFC<DL-.1THEN45
44 IFW=0ANDL1=1THENGOSUB105
45 IFA=32THENGOSUB65
46 POKEV,4+P:POKEWN,150+S:POKEV2,170+S/2
47 IFY=0THEN49
48 FORI=1TO300:NEXT:GOTO50
49 GOSUB97:LC=L1
50 IFD>DS-.13ANDD<DS-.1THENPOKE38735,0:POKE8015,136
51 IFC=DLTHENY=0:GOSUB78
52 IFC=DL+.1THENY=1:GOSUB78
53 IFD>DL-.4ANDD<DL-.2THENGOSUB97
54 GOTO11
55 PRINT"■"TAB(12)"■PASSED■RED■SIGNAL■":GOSUB70:LC=2:RETURN
56 PRINT"■"TAB(12)"■RAN■PAST■STATION■":GOSUB70:E=1:RETURN
57 PRINT"■"TAB(12)"■BROKEN■SPEED■LIMIT■":GOSUB70:P=0:S=S1*10:RETUR
N
58 PRINT"■"TAB(12)"■DIDN'T■SOUND■HORN■":GOSUB70:HS=1:RETURN
59 PRINT"■"TAB(12)"■LEFT■WITHOUT■GUARD'S■SIGNAL■"
60 GOSUB70:SG=1:RETURN
61 DR=0:PRINT"■"TAB(12)"■HIT■BUFFERS■":GOSUB70
62 DR$="FAIR":IFDR=<5THENDR$="POOR":GOTO64
63 IFDR>8THENDR$="GOOD"
64 PRINT"■"TAB(12)"■END■OF■JOURNEY■RATING■-"DR$"■":END
65 GOSUB106:POKEV3,199:FORI=1TO400:NEXT:POKEV3,182
66 FORI=1TO400:NEXT:IFPEEK(8015)<>136THEN68
67 HS=1
68 POKEV3,0:RETURN
69 F=22*L+G:PC=F+MC:PS=F+MS:POKEPC,T:POKEPS,160:RETURN
70 FORI=1TO3000:NEXT:FORG=12TO19:FORL=2TO6:T=0:GOSUB69:NEXTL,G:DR=DR-1:RETURN
71 FORL=2TO4:FORG=2TO8:GOSUB69:NEXTG,L:IFZ=1THEN73
72 PRINT"■":N$
73 FORL=15TO17:FORG=2TO5:GOSUB69:NEXTG,L:IF T=1THENSG=0
74 IFT=1THENZ=1:GOTO77
75 Z=0:HS=0:POKE7858,160:READ DS,N$,IN:IC=192:IFIN>0THENIC=206:GOTO77
76 IFIN<0THENIC=205
77 RETURN
78 IFY=1THEN80
79 IFL1=LSTHEN83
80 POKE38537,0:POKE7817,160:POKE38559,0:POKE7839,160
81 POKE38581,0:POKE7861,160:POKE38603,0:POKE7883,160
82 POKE 38646,0:POKE7926,160:POKE 38647,0:POKE7927,160:POKE38791,0:POKE7971,160
83 IFY=0THEN86
84 IFLC=1THENGOTO55
85 S1=SR:W=0:L1=L2:IX=IN:DL=DL+.5:GOTO96
86 IFC=15THEN95
87 IFL1=1THEN POKE38603,2:POKE7883,146
88 IFL1=2 THEN POKE38581,7:POKE7861,153
89 IFL1=3 THEN POKE38581,7:POKE7861,153:POKE38537,7:POKE7817,153
90 IFL1=4 THEN POKE38559,5:POKE7839,135
91 SR=7:IFC=0ORC=4.5ORC=8.5ORC=9ORC=>14THENSR=4
92 IFC=4ORC=8ORC=13.5THENSR=5
93 IFC=.5ORC=3.5ORC=7.5ORC=13THENSR=6
94 POKE38646,0:POKE7926,SR+176:POKE38647,0:POKE7927,176:Y=0:POKE7971,IC
95 IFC=>15ANDS=0THENGOTO62
96 RETURN
97 X=RND(0):LS=L1:L1=1
98 IFX>.97THENL1=2
99 IFX>.98THENL1=3
100 IFX>.99THENL1=4
101 IFL1< LSTHENL1=LS
102 L2=L1-1:IFL2<1THENL2=1
103 RETURN
104 GOSUB106:FORJ=1TO25:POKEV3,200:FORI=1TO40:NEXT:POKEV3,0:NEXTJ:SG=1:RETURN
105 GOSUB106:POKEV3,220:FORI=1TO500:NEXT:POKEV3,0:W=1:RETURN
106 POKEWN,0:POKEV2,0:POKEV,15:RETURN
```

Tunnel

Christopher Stops,
Bridgwater,
Somerset.

ZX-81

THIS GAME IS FOR the 1K ZX-81. It is in machine code and is therefore fast and compact. You have to move a man — the letter I — along a tunnel, but unfortunately trains are coming in the opposite direction. Your only chance is the dodge into the gaps in the tunnel-wall gap into the train, the game ends. top of the screen. If the train moves into the man, or the man attempts to move out of a tunnel wall gap into the train, the game ends. The trains move twice as fast as the man. To enter the program, it is first necessary to enter some space to put the machine code. Type in program 1.

Type in the hex loader with a Rem statement in line 10 containing at least 292 characters. If the computer will not let you Edit, type CLS then try again. If it still will not let you Edit, you will have to delete a line or two of the loader until you can Edit — do not forget the CLS — add the Xs then put the loader back by retyping the lines which you deleted. Run the program, entering the values in program 2.

When you have finished, do not delete the loader program, but replace it with program 3. Save the program and try running it. If it crashes, you will have to check the code. Enter program 4.

When you find a mistake, write down the address and what the contents should be, but then carry on in case there are any more mistakes. When you have finished, Load back the version which you Saved, Poke in the correct values and Save the program.

The various Pokes for this game are as follows:

16797: The speed. The smaller the number, the faster the speed.

16770: The length of train. Poke in any of the Bit (HL) instructions. For example, look on page 183 of the manual, right at the bottom. In the column labelled "—after CBH", you will see Bit 6,(HL). Looking across to the column on the left, you will see the number 118. Thus Poke 16770,118 will create a longish train. Poke 16770,86 will create very short trains. You will notice that 86 is Bit 2,(HL). The lower the number after Bit, the shorter the trains.

Also, in line 100, the gaps in the tunnel wall are set. The .8 in the part of the line with the RND can be changed, the lower the number, the easier the tunnel. You can only have one digit because as the program is, the memory is full. Adding a single character to any of the Print texts will cause an error report of 4 at some point in the game. The subroutine at line 200 onwards is a delay loop, as Sinclair's Pause causes the screen to flick. If you should happen to press Break while the

(continued on next page)

CHOOSING A HOME MICRO

WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

"DON'T LET THE ADD ONS ADD UP"

A number of large companies are offering packages that seem to be good value and low cost.
These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums.
e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit.
Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited.
Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution.
Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications; very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU.
If it is less than 32K think again, is it enough?

● Computer Language

It is too dificult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest.
A de facto standard in the computer industry is Microsoft BASIC.
Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you; able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money.

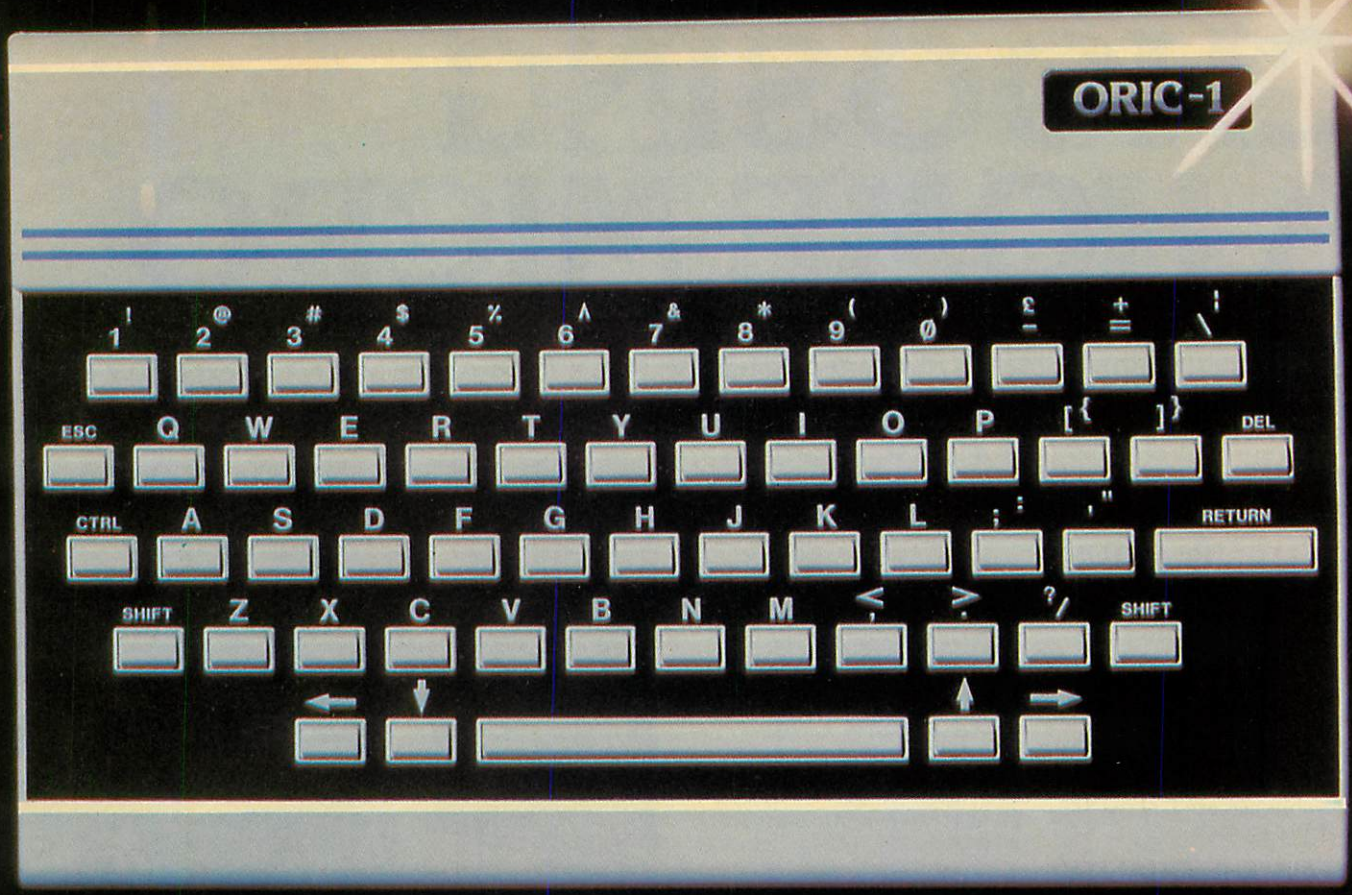


Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

To find out which company offers you the right choice, with:-

- Good value, high specification, quality micros.
- A quality, 4 colour, plain paper printer/ plotter.
- Communications Modem.
- Micro Disk Drives.
- Comprehensive and growing range of software

TURNOVER... →



The Growing System

ORIC 3" MICRO FLOPPY DISK DRIVE

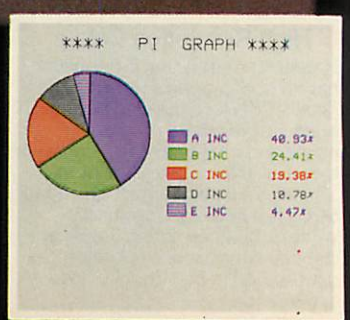
Coming soon the incredible new 3" Oric Micro Drives. Small size, Compact, High precision disks with storage capabilities from 100K Bytes to in excess of 1 Megabyte unformatted. With their own built-in power supply, these easy to use units will add big system capability to your home micro.



ORIC MCP 40 COLOUR PRINTER/PLOTTER

The Oric Colour Printer is quality engineered to provide 4 colour hard copy on plain paper, with superb graphics and text capability, printing either 40 columns or 80 columns. It prints in red, green, black and blue, onto a 4½" width standard paper roll. With a print speed of 12 characters a second, the MCP 40 comes with its own power supply and all necessary leads to connect straight into your Oric or to any standard Centronics interface.





This superb printer represents excellent value at just **£169.95 including VAT.**

ORIC PRODUCTS INTERNATIONAL LTD. COWORTH PARK, LONDON ROAD, ASCOT, BERKS.

(continued from page 205)

journey, a performance rating will be displayed.

The screen display seats you in the driver's cab of an multiple unit passenger train. In front of you are a speedometer, power and brake setting indicators and a digital clock.

You can see stations

From the left window you can see stations, signals and other trackside indicators, while the right window is used to inform you of any errors you have made.

Four keys are used to control the train as follows:

- Function key F1 — Increase power
- Function key F3 — Decrease power
- Function key F5 — Increase braking
- Function key F7 — Decrease braking
- Space-bar — Horn

The power and brake controls operate in the range 0 to 3 and the power cannot be applied until the brake setting is zero.

All signals are of the Four Aspect Colour Light type, and each has a letter superimposed on it indicating its colour so that anyone using a black and white television will still be able to recognise the signal setting. Operation of the signals is according to standard railway practice. There are four different signal indications — red, single yellow, double yellow and green. When a signal shows red, the train must be stopped. Signals showing any other colour may be passed, but the colour gives a warning of the state of the following signals.

Audible warning heard

A single yellow means that the next signal is at red, although it may have changed before it is reached. If it has not changed from red, an audible warning will be heard before the signal is reached and you must reduce speed so that the train can be brought to a halt when the signal appears.

A double yellow indication means that the next signal is at single yellow and a green indication means that the following signal is, at worst, a double yellow. In each case, the signal may have changed for the better before it is reached.

Typical timetable

A typical time-table for the journey for both express and stopping trains is as follows:

Station	Express	Local
Longcar	10.00	10.00
Weston	10.03	—
Redham	10.06	—
Marford	10.09	10.06
Cardale	10.12	—
Newtown	10.15	10.11
Colwood	10.18	—
Halton	10.21	—
Cragbay	10.24	—
Seaport	10.26	10.18

```
1 TT=1:T$="A LOCAL":PRINT"NIGHT TRAIN":IFRND(1)<.5THENTT=2:T$="AN EXPRE
SS"
2 PRINT"TONIGHT,YOU ARE       DRIVING "T$
3 PRINT"  TRAIN TO SEAPORT":FORI=1TO3000:NEXT:POKE 36879,254
4 L1=1:E=1:B=3:PRINT"":S1=4:TI$="095940":N$="LONGCAR":DR=10:D=.02:IC=197
5 MC=38400:MS=7680:V1=36874:V2=36875:V3=36876:WN=36877:V=36878:POKE36879,250
6 DATA1.3,WESTON,0,3.3,REDHAM,.1,5,MARFORD,-.2,7.3,CARDALE,0,9,NEWTOWN,-.3
7 DATA 10.3,COLWOOD,.4,12.3,HALTON,0,14.3,CRAGBAY,-.4,15,SEAPORT,0
8 FORL=2TO17:FORG=2TO9:T=0:GOSUB69:NEXTG,L
9 FORL=2TO17:FORG=12TO19:GOSUB69:NEXTG,L
10 PRINT" PWR  BRK"
11 PRINT""P;"  ";B:IFB>0THENP=0
12 S=S+P*0.3-B↑2*0.3-S/200-IX:IFS<0THENS=0
13 S$=STR$(INT(S)):IFS<10THENS$=" "+S$
14 PRINT"MPH"S$""LEFT$(TI$,4)""
15 D=D+S*.0002:C=INT(D*10+.5)/10:T1$=RIGHT$(TI$,2):T1=VAL(T1$)
16 IF S>S1*10+4THENGOSUB57
17 A=PEEK(203):IFA=64THEN22
18 IFA=39THENP=P+1:IFP>3THENP=3
19 IFA=47THENP=P-1:IFP<1THENP=0
20 IFA=55THENB=B+1:IFB>3THENB=3
21 IFA=63THENB=B-1:IFB<0THENB=0
22 IFZ=1ANDS=0THENE=1
23 IFGG=1ORS>0THEN25
24 GS=T1+10+INT(X*10):IFGS>59THENGS=GS-60:SG=0:GG=1
25 IFZ=1THEN33
26 IFTT=1THEN29
27 IFC=5.1ORC=9.1THEN29
28 GOTO30
29 IFZ=0ANDE=0THENGOSUB56
30 IFC<DSTHENE=1:GOTO35
31 E=0:T=1:GOSUB71
32 IFHS=0ANDC>.5THENGOSUB58
33 IFC<DS+0.1THEN35
34 T=0:GG=0:GOSUB71:GOTO43
35 IFD<DS+.01THEN37
36 POKE38578,0:POKE7858,19
37 IFD>15.04THEN61
38 IFZ=0THEN43
39 IFS>0THEN41
40 IFT1=GSTHENGOSUB104
41 IFE=0THEN43
42 IFS>3ANDSG=0THENGOSUB59
43 IFC<DL-.1THEN45
44 IFW=0ANDL1=1THENGOSUB105
45 IFA=32THENGOSUB65
46 POKEV,4+P:POKEWN,150+S:POKEV2,170+S/2
47 IFY=0THEN49
48 FORI=1TO300:NEXT:GOTO50
49 GOSUB97:LC=L1
50 IFD>DS-.13ANDD<DS-.1THENPOKE38735,0:POKE8015,136
51 IFC=DLTHENY=0:GOSUB78
52 IFC=DL+.1THENY=1:GOSUB78
53 IFD>DL-.4ANDD<DL-.2THENGOSUB97
54 GOTO11
55 PRINT""TAB(12)"PASSEDREDSIGNAL":GOSUB70:LC=2:RETURN
56 PRINT""TAB(12)"RANPASTSTATION":GOSUB70:E=1:RETURN
57 PRINT""TAB(12)"BROKENSPEEDLIMIT":GOSUB70:P=0:S=S1*10:RETUR
N
58 PRINT""TAB(12)"DIDN'TSOUNDHORN":GOSUB70:HS=1:RETURN
59 PRINT""TAB(12)"LEFTWITHOUTGUARD'SSIGNAL"
60 GOSUB70:SG=1:RETURN
61 DR=0:PRINT""TAB(12)"HITBUFFERS":GOSUB70
62 DR$="FAIR":IFDR=<5THENDR$="POOR":GOTO64
63 IFDR>8THENDR$="GOOD"
64 PRINT""TAB(12)"ENDOFJOURNEYRATING-"DR$"":END
65 GOSUB106:POKEV3,199:FORI=1TO400:NEXT:POKEV3,182
66 FORI=1TO400:NEXT:IFPEEK(8015)<>136THEN68
67 HS=1
68 POKEV3,0:RETURN
69 F=22*L+G:PC=F+MC:PS=F+MS:POKEPC,T:POKEPS,160:RETURN
70 FORI=1TO3000:NEXT:FORG=12TO19:FORL=2TO6:T=0:GOSUB69:NEXTL,G:DR=DR-1:RETURN
71 FORL=2TO4:FORG=2TO8:GOSUB69:NEXTG,L:IFZ=1THEN73
72 PRINT"":N$
73 FORL=15TO17:FORG=2TO5:GOSUB69:NEXTG,L:IF T=1THENSG=0
74 IFT=1THENZ=1:GOTO77
75 Z=0:HS=0:POKE7858,160:READ DS,N$,IN:IC=192:IFIN>0THENIC=206:GOTO77
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77 RETURN
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82 POKE 38646,0:POKE7926,160:POKE 38647,0:POKE7927,160:POKE38791,0:POKE7971,160
83 IFY=0THEN86
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85 S1=SR:W=0:L1=L2:IX=IN:DL=DL+.5:GOTO96
86 IFC=15THEN95
87 IFL1=1THEN POKE38603,2:POKE7883,146
88 IFL1=2 THEN POKE38581,7:POKE7861,153
89 IFL1=3 THEN POKE38581,7:POKE7861,153:POKE38537,7:POKE7817,153
90 IFL1=4 THEN POKE38559,5:POKE7839,135
91 SR=7:IFC=0ORC=4.5ORC=8.5ORC=9ORC=>14THENSR=4
92 IFC=4ORC=8ORC=13.5THENSR=5
93 IFC=.5ORC=3.5ORC=7.5ORC=13THENSR=6
94 POKE38646,0:POKE7926,SR+176:POKE38647,0:POKE7927,176:Y=0:POKE7971,IC
95 IFC=>15ANDS=0THENGOTO62
96 RETURN
97 X=RND(0):LS=L1:L1=1
98 IFX>.97THENL1=2
99 IFX>.98THENL1=3
100 IFX>.99THENL1=4
101 IFL1< LSTHENL1=LS
102 L2=L1-1:IFL2<1THENL2=1
103 RETURN
104 GOSUB106:FORJ=1TO25:POKEV3,200:FORI=1TO40:NEXT:POKEV3,0:NEXTJ:SG=1:RETURN
105 GOSUB106:POKEV3,220:FORI=1TO500:NEXT:POKEV3,0:W=1:RETURN
106 POKEWN,0:POKEV2,0:POKEV,15:RETURN
```

Tunnel

Christopher Stops, Bridgwater, Somerset.

ZX-81

THIS GAME IS FOR the 1K ZX-81. It is in machine code and is therefore fast and compact. You have to move a man — the letter I — along a tunnel, but unfortunately trains are coming in the opposite direction. Your only chance is the dodge into the gaps in the tunnel-wall gap into the train, the game ends. top of the screen. If the train moves into the man, or the man attempts to move out of a tunnel wall gap into the train, the game ends. The trains move twice as fast as the man. To enter the program, it is first necessary to enter some space to put the machine code. Type in program 1.

Type in the hex loader with a Rem statement in line 10 containing at least 292 characters. If the computer will not let you Edit, type CLS then try again. If it still will not let you Edit, you will have to delete a line or two of the loader until you can Edit — do not forget the CLS — add the Xs then put the loader back by retyping the lines which you deleted. Run the program, entering the values in program 2.

When you have finished, do not delete the loader program, but replace it with program 3. Save the program and try running it. If it crashes, you will have to check the code. Enter program 4.

When you find a mistake, write down the address and what the contents should be, but then carry on in case there are any more mistakes. When you have finished, Load back the version which you Saved, Poke in the correct values and Save the program.

The various Pokes for this game are as follows:

16797: The speed. The smaller the number, the faster the speed.

16770: The length of train. Poke in any of the Bit (HL) instructions. For example, look on page 183 of the manual, right at the bottom. In the column labelled "—after CBH", you will see Bit 6,(HL). Looking across to the column on the left, you will see the number 118. Thus Poke 16770,118 will create a longish train. Poke 16770,86 will create very short trains. You will notice that 86 is Bit 2,(HL). The lower the number after Bit, the shorter the trains.

Also, in line 100, the gaps in the tunnel wall are set. The .8 in the part of the line with the RND can be changed, the lower the number, the easier the tunnel. You can only have one digit because as the program is, the memory is full. Adding a single character to any of the Print texts will cause an error report of 4 at some point in the game. The subroutine at line 200 onwards is a delay loop, as Sinclair's Pause causes the screen to flick. If you should happen to press Break while the

(continued on next page)

(continued from previous page)

program is in the loop, there will be a return address left on the Gosub stack, which will cause the memory to run out. The only way to clear it off is to press Return, breack the program, and continue to do this until you get error 7, showing that there are no addresses left on the stack.

Notice the memory saving methods used such as Goto Code. Also notice that although the lines go up in 10's, there is a line 128. This is because there is no easily accessible character for 120, but the Code of an inverse space is 128.

The controls for the train game are any key along the top row to move up, and any key along the bottom row to move down, any key to the right to move right and any key to the left to move left.

Program 1.

```
  10 REM XXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
  20 LET A=16514
  30 INPUT B
  40 POKE A,B
  50 LET A=A+1
  60 GOTO 30
```

Program 2.

```
16514 - 185 174 178 170 142
16519 - 8 8 8 8 8
16524 - 8 8 8 8 8
16529 - 8 0 8 8 8
16534 - 8 8 8 8 0
16539 - 8 0 8 8 8
16544 - 0 0 8 8 8
16549 - 8 8 8 8 0
16554 - 0 8 8 8 8
16559 - 0 0 0 8 8
16564 - 8 0 8 8 8
16569 - 8 8 8 8 8
16574 - 0 0 8 8 8
16579 - 0 8 8 8 8
16584 - 5 33 130 64 126
16589 - 215 35 16 251 82
16594 - 156 6 27 215 16
16599 - 253 62 8 6 32
16604 - 215 16 253 6 32
16609 - 126 215 35 16 251
16614 - 82 0 6 32 215
16619 - 16 253 6 32 126
16624 - 215 35 16 251 82
16629 - 8 6 32 215 16
16634 - 253 42 12 64 17
16639 - 98 0 25 54 46
16644 - 33 33 64 52 203
16649 - 70 40 76 42 12
16654 - 64 35 126 254 46
16659 - 32 250 229 205 187
16664 - 2 125 225 68 77
16669 - 17 33 0 203 95
16674 - 40 4 203 103 32
16679 - 4 198 0 237 82
16684 - 203 87 40 4 203
16689 - 79 32 1 43 203
16694 - 111 40 4 203 119
16699 - 32 1 35 203 71
16704 - 40 4 203 127 32
16709 - 1 25 126 254 139
16714 - 200 254 8 40 9
16719 - 254 118 40 5 62
16724 - 0 2 54 46 42
16729 - 12 64 17 131 0
16734 - 25 126 254 139 32
16739 - 14 35 126 254 46
16744 - 200 254 118 40 2
16749 - 54 139 43 54 0
16754 - 43 126 254 118 32
16759 - 232 35 126 254 46
16764 - 200 229 33 52 64
16769 - 203 126 225 40 2
16774 - 54 139 42 12 64
16779 - 17 32 0 25 126
16784 - 60 254 166 32 5
16789 - 54 166 43 24 245
16794 - 119 1 1 10 11
16799 - 120 177 32 251 195
16804 - 4 65
```

Program 3.

```
  20 PRINT "NEW TUNNEL (Y/N) ?"
  30 PRINT
  40 IF INKEY$="Y" THEN GOTO COD
E "Z"
  50 IF INKEY$="N" THEN GOTO COD
E "■"
  60 GOTO CODE "C"
  70 PRINT "HALF A MO....."
  80 PRINT
  90 FOR A=VAL "16519" TO VAL "1
6582"
 100 POKE A,VAL "8"+(RND<VAL ".8
")
 110 NEXT A
 120 PRINT "GOOD LUCK."
 130 GOSUB CODE "COS "
 140 LET A=USR VAL "16583"
 150 GOSUB CODE "COS "
 160 RUN
 200 FOR A=VAL "0" TO CODE "■"
 210 NEXT A
 220 CLS
 230 RETURN
```

Program 4.

```
20 FOR A=16514 TO 16805
25 SCROLL
30 PRINT A;":";PEEK A
40 REM LINE 50 IS OPTIONAL
50 LPRINT A;":";PEEK A
60 NEXT A
```

Maze

I Brown,
Marshalltown,
South Africa.

DRAGON

THIS PROGRAM IS based on a program written by Gary Shannon many years ago for the Apple 2. I have changed the logic significantly in adapting the program for the Spectrum, and have improved the screen display by the use of user-defined graphics together with the machine-code routine by Robert Newman in the April 1983 issue of *Your Computer.*

When the program is loaded it will auto-run, and will generate a maze on the screen which you should try to remember as much of as possible. The reason for remembering is that the lines defining the maze are then rubbed out, and you are expected to make your way to the exit of the maze while avoiding the dragon which is homing in on you. The walls only become visible once you bump into them, and at the same time you lose a point. The dragon's movements are also constrained by the walls, but with two differences: first, he does not make a wall appear if he bumps into it; and secondly, after nine attempts he goes straight through the wall anyway.

The keys used to move the player's man around the maze are Q and Z for up and down and I and P for left and right respectively. You will also lose points if you press any other key, or if you try to move in a direction which would take you through the outer bounds of the maze — the thick lines. Should you find the noise made under these conditions to be annoying, you can change the randomise statement in line 450 to

BEEP .5, -20

The program has been written in compromise mode. The main requirement was that the program should run in a 16K machine; the second, that it should run as fast as possible. To satisfy the first condition, the program was initially written making extensive use of functions and named constants. The response was found to be unacceptable, however, so the program was amended to its current form which uses a bit more memory but runs a lot faster. For reasons of space, the inclusion of instructions in the program was not considered.

First punch in the program shown in listing 1, and save it to cassette. A very simple checksum is included in the program to carry out a check on the accuracy of punching of the Data statements when you run it. Note that the program uses the C routine found on the Horizons cassette which is suppled free with every Spectrum; the most accessible version of this code is on side B of the cassette.

Once this has been loaded the program sets

(continued on page 213)

```
  10 REM - SET UP M/C CODE + USER-DEFINED GRAPHICS + SOUNDS
  20 LOAD "C" CODE 32256,300
  30 LET TOTAL=0
  40 RESTORE : FOR N = 31951 TO 32255 : READ A : LET TOTAL=TOTAL+A : POKE N,A :
NEXT N
  50 READ CHECKSUM : IF TOTAL <> CHECKSUM THEN CLS : PRINT "PUNCHING INCORRECT :
"''''"CALCULATED = ";TOTAL''"   SHOULD BE ";CHECKSUM : STOP
  60 SAVE "DRAGONCODE" CODE 31951,605 : STOP
  70 REM - M/C CODE MOVE ROUTINE
  80 DATA 0,0,0,0,0,0,0,0,0,0,221,42,178,92,221,35,42
  90 DATA 123,92,221,94,5,29,203,35,203,35,203,35,22,0,25,235,221,78
 100 DATA 0,221,70,1,221,126,3,245,197,221,126,2,221,119,6,205,170,34
 110 DATA 221,119,7,221,52,7,47,230,7,60,221,119,8,213,229,205,219,11
 120 DATA 225,209,221,203,4,70,32,5,1,0,0,24,5,235,70,35,78,235
 130 DATA 221,54,9,8,221,54,10,9,126,221,53,7,40,9,7,221,53,10
 140 DATA 221,53,7,32,247,203,33,203,16,23,221,53,10,221,53,6,32,19
 150 DATA 221,53,10,40,6,7,221,53,10,32,250,119,193,241,5,61,32,155
 160 DATA 201,221,53,9,32,10,221,203,4,70,40,4,235,35,78,235,221,53
 170 DATA 8,32,204,221,53,10,40,6,7,221,53,10,32,250,119,35,213,229
 180 DATA 245,205,219,11,241,225,209,221,54,8,8,221,54,7,1,24,153
 190 REM - ZAPP SOUND
 200 DATA 6,20,197,33,0,3,17,1,0,229,205,181,3,225,17,16,0,167,237,82,32,240,193
,16,233,201
 210 REM - HIT WALL SOUND
 220 DATA 6,50,197,33,0,1,17,1,0,229,205,181,3,225,17,16,0,167,237,82,32,240,193
,16,233,201
 230 REM - DEFINE DRAGON
 240 DATA 99,0,247,128,157,192,15,192,87,192,175,192,7,192,143,192,251,192,113,1
92
 250 DATA 0,0,0,0
 260 REM - DEFINE MAN
 270 DATA 28,0,20,0,28,0,136,128,127,0,28,0,28,0,20,0,20,0,54,0
 280 DATA 0,0,0,0
 290 REM - DEFINE ARROW
 300 DATA 24,12,6,255,255,6,12,24
 310 REM - CHECKSUM VALUE
 320 DATA 28500
1000 SAVE "PROG1"
```

LISTING 1 - PROGRAM TO CREATE "DRAGONCODE"

NOTE :- IT IS IMPORTANT THAT A LOWER-CASE "C" IS PUNCHED IN LINE 20
****

Dragon Dungeon

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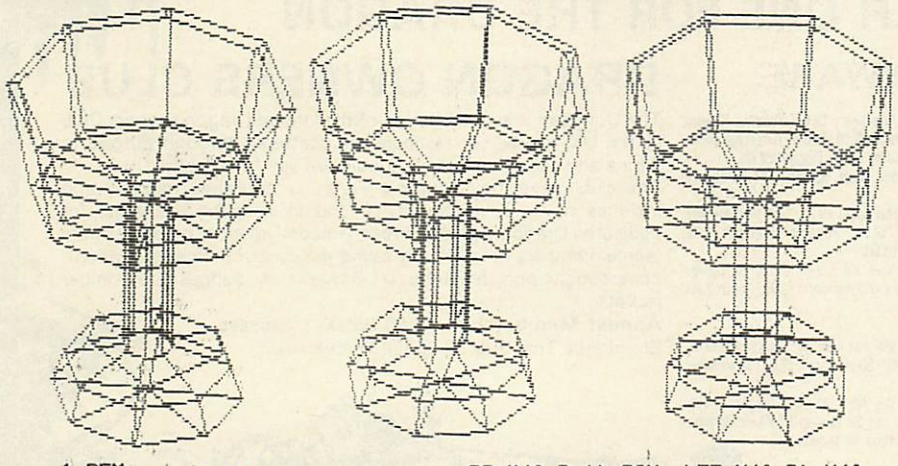
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Goblet

Philip Jones,
Abingdon,
Oxfordshire.

SPECTRUM



THIS PROGRAM IS designed to take a halfcross-section of an object and rotate it about the y-axis in eight stages thereby giving the picture of the object in a 3-D wire frame drawing. The 3-D picture is then rotated through 7.5 degrees and redrawn five times. Each time the picture is Saved in memory by a short machine-code program. When the drawing is complete, these pictures are called back in rapid succession to give the effect of the object spinning at about 20 rpm.

To create an object enter the x and y co-ordinates of the points joined together in order — up to a maximum of 16 — and then a number bigger than 256 to start the rest of the program. For example to draw a goblet enter 0, 0, 40, 0 35, 10, 10, 15, 10, 60, 50, 65, 60, 100, 55, 100, 45, 70, 0, 64, 555. Make sure the co-ordinates are such that the third dimension will not try and draw a line off the screen. It is best to start and finish with the y variable equal to zero. When you have finished drawing, enter 555 as an x co-ordinate.

The high-speed spinning can only be achieved on a 48K Spectrum because of the vast amount of memory taken in Saving the screens — nearly 37K — but wire frame pictures are possible on a 16K by deleting lines 1 to 130, line 600, line 603, line 850, lines 1000 to 1050 and changing 990 to 990 Go To 602.

```
  1 REM .............
 100 FOR A=23760 TO 23771
 110 READ B: POKE A,B
 120 NEXT A
 130 DATA 33,0,64,17,0,230,1,0,2
4,237,176,201
 500 DIM X(16,8): DIM Y(16,8): D
IM Z(16,8): LET SIN=SIN (PI/4):
LET COS=COS (PI/4)
 510 INPUT "X";X(1,1),"Y";Y(1,1)
: LET Z(1,1)=0
 520 PLOT X(1,1)+128,Y(1,1)+30
 530 FOR C=2 TO 16
 540 INPUT "X";X(C,1): IF X(C,1)
>255 THEN GO TO 590
 541 INPUT ,"Y";Y(C,1): LET Z(C,
1)=0
 550 DRAW X(C,1)-X(C-1,1),Y(C,1)
-Y(C-1,1)
 560 PLOT X(C,1)+128,Y(C,1)+30
 570 NEXT C
 590 BORDER 0: PAPER 0: INK 7: C
LS
 600 POKE 23760,33: POKE 23763,1
7
 602 FOR Q=0 TO 5
 603 POKE 23765,110+24*Q
 605 FOR B=2 TO 8
 610 FOR A=1 TO C-1
 620 LET X(A,B)=X(A,B-1)*COS-Z(A
,B-1)*SIN: LET Z(A,B)=Z(A,B-1)*C
OS+X(A,B-1)*SIN: LET Y(A,B)=Y(A,
B-1)
 630 NEXT A
 640 NEXT B
 690 CLS
 700 FOR B=1 TO 7
 710 FOR A=1 TO C-2
 720 PLOT 128+X(A,B),30+Y(A,B)-0
.5*Z(A,B)
 730 DRAW (X(A,B+1))-(X(A,B)),(Y
(A,B+1)-0.5*Z(A,B+1))-(Y(A,B)-0.
5*Z(A,B))
 740 DRAW (X(A+1,B+1))-(X(A,B+1)
),(Y(A+1,B+1)-0.5*Z(A+1,B+1))-(Y
(A,B+1)-0.5*Z(A,B+1))
 750 NEXT A
 760 NEXT B
 800 FOR A=1 TO C-2
 810 PLOT 128+X(A,B),30+Y(A,B)-0
.5*Z(A,B)
 820 DRAW (X(A,1))-(X(A,B)),(Y(A
,1)-0.5*Z(A,1))-(Y(A,B)-0.5*Z(A,
B))
 830 DRAW (X(A+1,1))-(X(A,1)),(Y
(A+1,1)-0.5*Z(A+1,1))-(Y(A,1)-0.
5*Z(A,1))
 840 NEXT A
 850 RANDOMIZE USR 23760
 900 FOR A=1 TO C-1
 910 LET XN=X(A,1)*COS (PI/24)-Z
(A,1)*SIN (PI/24)
 920 LET ZN=Z(A,1)*COS (PI/24)+X
(A,1)*SIN (PI/24)
 930 LET X(A,1)=XN: LET Z(A,1)=Z
N
 940 NEXT A
 950 NEXT Q
 990 BEEP .5,30
1000 POKE 23760,17: POKE 23763,3
3
1010 FOR Q=0 TO 5
1020 POKE 23765,110+24*Q
1030 RANDOMIZE USR 23760
1040 NEXT Q
1050 GO TO 1010
```

Night Train

A M Dyer,
Strathclyde.

VIC-20

THIS PROGRAM PUTS you in charge of an electronic passenger-carrying train on a night journey from a fictional city terminus to a coastal town some 15 miles away with eight stations between.

You are expected to make decisions and take the appropriate actions which would be expected of a real driver. Sometimes you are required to drive an express train with only two stops on route, while at other times, you may need to stop at every station.

The main functions expected of the driver are to obey the colour light signals and the speed restrictions and make the required stops at the appropriate stations. Other features of the program include gradients, horn warning signs, guard's permission to leave signal, red signal warning, driver's error indications and performance rating. In the driver's cab, power, brake and horn controls are provided in addition to speed and time displays.

In the driver's cab, power, brake and horn controls are provided in addition to speed and time displays.

A considerable degree of skill and anticipation is required in judging stopping distance in relation to train speed, gradient and distance to run. It will be found that getting to know the road is as vital as it is in real life.

Below the signal lights a number will appear indicating the speed limit on the next section of track. The speed restriction takes effect after the signal has been passed.

A symbol also appears beneath the signals, informing you of the gradient of the track. The symbol — indicates level track, / indicates an ascent while \ indicates a descent.

Shortly before each station, an H sign will appear at the trackside, requiring the horn to be sounded as a warning of the train's approach. After entering a station, the train should not finally be brought to a rest until an S sign appears on the station wall. This ensures that the train is conveniently positioned for passengers alighting or boarding.

At the start of the journey, you will be informed whether you are to drive an express or a local train. The express is required to stop at Marford, Newtown and Seaport while the local train must stop at all stations.

The windows, controls and instruments are then displayed and Longcar station and the first signal can be seen through the left window.

Before you can depart, the signal must have changed from red, and the guard's permission-to-leave buzzer must have sounded. When you are free to go, take off the brakes, increase power and the train will begin to move.

If you make mistakes, an error message will appear in the right-hand window and a record is kept of your score. On completion of the

(continued on page 207)

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First, all future MSX hardware–i.e. computers, peripherals, appliances–will be based on several key design elements of the SV-318. What does this mean to you, the consumer? A great deal, because when you buy an SV-318, you will not only be able to use all of Spectravideo's own software and hardware–you'll also be able to take advantage of all the remarkable new equipment that will be coming from other MSX participants.

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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

ADVENTURE NAME

I am very interested in writing adventure programs on my Oric. The only thing is that I find I am always running out of ideas for names of monsters and items of treasure. I am sick of all the usual things like "wicked wizards", "hungry dragons" and "chests of gold". How can I write a program to make up new monsters and treasure ideas?

Martin Newson, Birmingham.

I CANNOT IMAGINE how you can write a program which can actually generate the things you ask, although it would not be difficult to write a program to choose from a large store of such things. Another program could easily be written to create random names for your monsters or place locations. A more sensible approach might be to invest in a few books and games sets in the field such as the following, which I have found useful: *Book 0, An Introduction to Traveller* (Game Designers' Workshop); *What is Dungeons and Dragons** (Butterfield J., Parker P., and Honigmann, D., Penguin); *Through Dungeons Deep: A Fantasy Games' Handbook* (Robert Plamondon, Reston); *Fantasy Role-Playing Games* (J Eric Holmes, Hippocrene Books). As well, you are sure to find material of interest in the basic set of *Dungeons and Dragons** boxed game, and the *Dungeon Geomorphs* and *Monster and Treasure* selections they publish separately should also prove of interest and value.

FAULTY POWER?

I recently bought a second-hand ZX-81 but have since been told that some of them have a faulty power-pack. The original owner cannot be traced but I believe he bought it early this year. It has a black and white lead. I phoned Sinclair but they told me only the Spectrum had had a problem. However, we are sure there was something in the press about the ZX-81. Please help as we are wary of using it.

Jillian Straight, Gravesend, Kent.

WHY WOULD YOU believe me if you do not believe Sinclair? The problem with the Spectrum power supply — which has, by the way, been totally rectified — lay in the small number of power supplies which came from one manufacturer. Sinclair recalled, and replaced, all the ones which were in any way suspect. There have been no problems with ZX-81 power supplies which are specific to groups of power units produced by specific suppliers. Sinclair would not try to mislead you over a matter as serious as this. You can use your ZX-81 without concern.

FASTER CBM 64

My "arcade games" for the Commodore 64 are depressingly slow. What is the best way to speed them up?

B. Chandler, Chalfont St Giles.

THE ANSWER IS simple: Write them in machine code rather than Basic. As you know, that is easier to suggest than it is to follow. You will find the Commodore 64 Programmer's Reference Guide has a major section called 'Basic to Machine Language' which should prove very helpful. If you feel you are not ready for that step yet, note that careful structuring of your Basic programs can produce a significant increase in speed.

MEMORY LOSS

I have been writing a very long program on the Oric to handle personal financial accounts. I hope to put the program on the market in due course. I am trying to make it as simple as possible to operate, with many clear prompts for the user. However, this means that a lot of memory is being used up just for the Print statements used for these user prompts. I am afraid, even though I am working with a 48K machine, that I will run out of memory shortly. How can I get more into the machine?

Roger Miller, Seaton.

ORIC HAS A COMMAND called Grab which assigns the area in memory from 9800 to B400 on the 48K machine to user memory. Of course, this only works in the Text mode, and Hires is not available. I do not imagine this will be a problem, as all your output is likely to be in Text.

CHARACTERS

I own a Vic-20 and have recently found a method of creating user-defined characters:

```
10 PRINT "CLR":POKE 36869,255
20 FOR X=1 TO 8:READ B:POKE
   7167 + X,B:NEXT
30 DATA 0,0,0,0,0,0,0,0
```

When I incorporate this into a games program at the start, after a few minutes play the characters start reverting back into garbage again. Is there a safe method of creating characters that last? All the games I have bought do.

J. Wells, Herne Hill, London.

THE KEY TO DEFINING your own characters is understanding how the contents of memory are represented on the screen. Normally each code in the area of memory from 7680 to 8185 is scanned by the Vic and its contents interpreted as references to another area of memory which defines the shape of each character which can be displayed. One simple — but rather barbaric — way of ensuring your characters maintain their integrity is to first make sure that nothing else you do Pokes into the locations you have used, and secondly to periodically rePoke the shape into place. There are probably points within the program — such as displaying the score at the end of a round — where the time taken to Restore and rePoke the graphics will not be noticed.

WHAT DO I BUY?

I have read your magazine for the first time and, as a non-computer user who will in all probability become a computer user, I found the whole thing more than a little confusing. Although in your news column you did as I would expect, give an airing to several new products, there was no direct criticism of the products involved. The point I am trying to make is this. How can anyone who has little or no experience go and buy any hardware from whatever source when one is unable to ascertain what a particular machine will or will not do? It is all very well to say "rely on the dealer; he will tell you". However, in what is a relatively new industry, there has been only a short period of time for the rank and file operators within the industry to become expert at advising the consumer of the best hardware for his or her needs. Let me give another example. Sinclair currently has a 48K machine on offer for just under £130, yet a less powerful machine from the BBC is almost £400 or the Dragon 32 is only £200. Apart from the obvious cosmetic differences, what are the real differences? Is everyone who buys a BBC machine being ripped off? Surely not. I would suggest that direct comparisons such as these should appear in your columns in much the same way as you would find in most motoring magazines. I am sorry if I appear scathing in the things I have written, but I do feel that a good publication such as *Your Computer* could be made better.

Malcolm Pattinson, South West Denton, Newcastle.

LETTERS SUCH AS YOURS come into our office every day. The basic message is "I don't know anything about computers, so which is the best one to buy?". Unfortunately, there is no easy way to answer this. The factors that come into a computer purchase are far different from those which influence the buying of a car, so the motoring magazine analogy is, I am afraid, invalid.

The usual way I proceed to answer this question is to ask two others: how much do you have to spend? and what do you want to do with the computer? On these two answers hang all the advice I could give.

Your Computer does, however, do in-depth, critical reviews of computers but cannot — of course — reprint each of these every month. I would never advise anyone buying a computer to "rely on the dealer" as my experience in places like London's Tottenham Court Road suggests that the level of expertise in many cases is so low the salesperson is not even capable of judging when the customer actually knows something about the product under discussion. "It plays a real neat Pacman, which plugs in the side here" is, in many cases, the response to almost any question.

I do not know how on earth you have decided that the BBC Micro is "less powerful" than the Spectrum, or that the Dragon can be directly and meaningfully compared with either machine. You appear to have assumed that memory supplied with the computer is a measure of power which is not the case.

The confusion over this simply highlights the fact that buying a microcomputer can be a minefield, or it can be relatively simple. With computers, there is almost a direct correlation between price and quality. The more you pay, the more you get, in terms of quality of production, service backup, flexibility of operation, and ease of use. This is one way to buy. Another is to check out your local computer store, and see which computer is best supported by software and publications. If there is a lot of backup material, this proves many people have found the computer to their liking.

I generally advise those uncertain of which machine to buy, to buy one at the very bottom of the price range, and then use this for six months or so. Buy a cheap machine, live with it for some months, and you will discover either that you do not like computing, the machine you have is ideal for your needs, or you may, in due course, want another computer. In any case, you are in a position to make an informed, next move.

CORRECTION

Ian Hegerty reprimands me:

"In Response Frame — June 1983 — I was surprised to find Tim Hartnell telling a ZX-81 user that perhaps his program crashed because he had forgotten to 'end each routine with an RTS(96)'. Perhaps Mr Hartnell had forgotten that the ZX-81 has a Z80 processor. Thus the routine should end with a RET (201 decimal, C9 hex) instruction."

Thanks for the correction, Ian. I do get my wires — and my processors — confused sometimes.

(continued from page 213)

Line 10005 empties the keyboard buffer.
Line 10011 — Z1 is the start location of the high-resolution screen Z2 is the end of the high-resolution screen.
Lines 10020 to 10240 are the screen Save and Load routine.

Watch data statements

On typing in the program, be careful of the data statements. If any data statements are incorrect the system will hang-up. It is advisable to Save the program to either disc or tape before running. Once saved, type Run, there will be a short pause and then the screen should go red and blank.

Now is the time to plug your joystick into Port 1. Moving the joystick will cause a line to be drawn in that direction i.e., on moving the joystick to the right a line will be drawn from left to right etc. However, if the fire button is held down when moving the joy-stick, the position on the screen will move in the appropriate direction, but no line will be drawn. F1 erases the whole screen, so beware.

Load and Save routines

F3 allows access to the Load and Save routines, the prompt "Disc or Tape" appears on the screen, answer D or T appropriately. The prompt "Load or Save" appears on the screen, answer L or S appropriately. The necessary action will then be taken. Saving to disc is a lot quicker than to tape. If using tape, be prepared for a long wait.

```
0 FORT=20000TO20121:READA:POKET,A:NEXTT
10 BASE=2*4096
11 SYS20000:SYS20071
12 POKE53272,PEEK(53272)OR8
13 POKE53265,PEEK(53265)OR32
20 X=160:Y=100
30 P=PEEK(56321):A=PEEK(197)
40 IFP=247THENX=X+1
50 IFP=251THENX=X-1
60 IFP=254THENY=Y-1
70 IFP=253THENY=Y+1
80 IFP=246THENX=X+1:Y=Y-1
90 IFP=245THENX=X+1:Y=Y+1
91 IFP=249THENX=X-1:Y=Y+1
92 IFP=250THENX=X-1:Y=Y-1
100 CH=INT(X/8):RO=INT(Y/8):LN=YAND7:BY=BASE+RO*320+8*CH+LN:BI=7-(XAND7)
110 POKEBY,PEEK(BY)OR(2↑BI)
120 IFA=4THENSYS20000:SYS20071
121 IFA=5THEN10000
130 GOTO30
410 DATA169,0,133,251,169,32,133,252,160,0,169,0,145,251,230,251,197,251,240,2
420 DATA208,246,230,252,169,64,197,252,208,236,169,0,133,251,169,4,133,252
430 DATA160,0,138,145,251,230,251,169,232,197,251,208,7,169,7,197,252
440 DATA208,1,96,152,197,251,240,4,138,24,144,230,230,252,24,144,224
450 DATA255,162,0,169,18,157,0,4,232,224,255,208,248,162,0,169,18,157,255,4,232
460 DATA224,255,208,248,162,0,169,18,157,254,5,232,224,255,208,248,162,0,169
470 DATA18,157,253,6,232,224,235,208,248,96
10000 REM* * * SCREEN SAVE * * *
10005 POKE198,0
10010 PRINT"□":POKE53265,27:POKE53272,21
10011 Z1=8192:Z2=16191
10020 INPUT"FILE NAME 16 MAX";Z$
10030 INPUT" ■DISC OR ■TAPE";T$
10040 IFT$="D"THENX=8
10050 IFT$="T"THENX=1
10060 INPUT" ■LOAD OR ■SAVE";S$
10070 IFS$="L"THEN10160
10080 IFS$="S"THEN10100
10100 OPEN1,X,1,Z$
10110 FORSS=Z1TOZ2
10120 MC=PEEK(SS)
10130 PRINT#1,MC
10140 NEXTSS:CLOSE1
10150 GOTO11
10160 POKE53272,PEEK(53272)OR8:PRINT"□":SYS20000:SYS20071
10161 POKE53265,PEEK(53265)OR32
10200 OPEN1,X,0,Z$
10210 FORSS=Z1TOZ2
10220 INPUT#1,A
10230 POKE(SS),A
10240 NEXTSS:CLOSE1
10250 GOTO30
```

Synth

Jonathan Bull,
Taunton,
Somerset.

ORIC

THIS PROGRAM ENABLES any Oric computer to be used as a synthesiser. The program requires the user to input variables for the Play and Music commands. This means that a wide variety of sounds can be produced.

The built-in speaker although loud does not give much quality of sound, so I plugged the Oric sound output into the external source of my hi-fi using a five-pin DIN wire. The loudness, treble and bass can now be adjusted more easily. When inputting numbers you must make sure they are within the limits printed.

Three main screens

There are three main screens: first, the instructions, then data input screen and then a display of the numbers chosen for the Play and Music commands. The two hands use separate keys, as on a synthesiser: the left-hand, keys K-M; the right-hand, keys Y-]. Before running the program it is a good idea to turn the key click off — CTRL F.

Lines 40 to 80 set up the screen.
Lines 100 to 270 print the instructions.
Line 28 scans the keyboard to see if a key has been pressed.
Lines 290 to 330 set up the second screen.
Lines 350 to 660 print the input requests.
Lines 670 to 710 set up the third screen.
Lines 720 to 820 print the variables.
Lines 880 to 1030 assign variables to their commands.

```
10 REM **  Synthesizer  **
20 REM ** Jonathan Bull **
30 REM **     14/7/83    **
35 K$=KEY$
40 TEXT:CLS:INK5:PAPER0
50 PRINT CHR$(4)
60 PRINT CHR$(27);"T";CHR$(27);"B";CHR$(27);"N";
70 PRINT"       S y n t h e s i z e r"
80 PRINT CHR$(4)
90 PRINT:PRINT
100 PRINT"This program allows you to choose the"
1~0 PRINT"values for the 'MUSIC' and 'PLAY'"
120 PRINT"commands. By being able to choose and"
130 PRINT"change the values of the commands manydiffer
ent sounds ca
n be made."
140 PRINT"To change the values press A."
145 PRINT"To get back to this page press Q"
150 PRINT"The right hand playes keys Y-]"
160 PRINT"The left hand playes keys Z-M"
170 PRINT"You enter values as whole numbers      follow
ed by RETURN.
"
175 PRINT
180 PRINT"-------------------------------------"
190 PRINT"¦ MUSIC ¦(channel)¦(octave)¦(volume)¦"
200 PRINT"¦       ¦   (1-3)  ¦  (0-6)  ¦  (0-15) ¦"
210 PRINT"-------------------------------------"
230 PRINT"-------------------------------------"
240 PRINT"¦PLAY¦(tone)¦(noise)¦(mode)¦(peroid)¦"
250 PRINT"¦    ¦(0-7) ¦  (0-7) ¦(1-7) ¦(0-32767¦"
```

(continued on next page)

(continued from previous page)

```
260 PRINT"----------------------------------------"
270 PRINT"      Press any key to continue"
280 GET A$
290 TEXT:CLS:INK3:PAPER0
300 PRINT CHR$(12)
310 PRINT CHR$(4);CHR$(27);"T";CHR$(27);"B";CHR$(27);"
N";
320 PRINT"      S y n t h e s i z e r"
330 PRINT CHR$(4)
340 PRINT:PRINT
350 PRINT"RIGHT HAND:MUSIC"
360 PRINT"Input channel (1-3)"
370 INPUTB%
375 IFB%<1ORB%>3THEN360
380 PRINT"Input octave (0-6)"
390 INPUTC%
395 IFC%<0ORC%>6THEN380
400 PRINT"Input volume (0-15)"
410 INPUTD%
415 IFD%<0ORD%>15THEN400
420 PRINT"LEFT HAND:MUSIC"
430 PRINT"Input channel (1-3)"
440 INPUTI%
445 IFI%<1ORI%>3THEN430
450 PRINT"Input octave (0-6)"
460 INPUTJ%
465 IFJ%<0ORJ%>6THEN450
470 PRINT"Input volume (0-15)"
480 INPUTL%
485 IFL%<0ORL%>15THEN470
490 PRINT"RIGHT HAND:PLAY"
500 PRINT"Input tone enable (0-7)"
510 INPUTE%
515 IFE%<0ORE%>7THEN500
520 PRINT"Input noise enable (0-7)"
530 INPUTF%
535 IFF%<0ORF%>7THEN520
540 PRINT"Input envelope mode (1-7)"
550 INPUTG%
555 IFG%<1ORG%>7THEN540
560 PRINT"Input envelope period (0-32767)"
570 INPUTH%
575 IFH%<0ORH%>32767THEN560
580 PRINT"LEFT HAND:PLAY"
590 PRINT"Input tone enable (0-7)"
600 INPUTM%
605 IFM%<0ORM%>7THEN590
610 PRINT"Input noise enable (0-7)"
620 INPUTN%
625 IFN%<0ORN%>7THEN610
630 PRINT"Input envelope mode (1-7)"
635 INPUTO%
640 IFO%<1ORO%>7THEN630
650 PRINT"Input envelope period (0-32767)"
655 INPUTP%
660 IFP%<0ORP%>32767THEN650
670 TEXT:CLS:INK2:PAPER0
680 PRINT CHR$(12)
690 PRINT CHR$(4);CHR$(27);"T";CHR$(27);"B";CHR$(27);"
N";
700 PRINT"      S y n t h e s i z e r "
710 PRINT CHR$(4):PRINT:PRINT
720 PRINT"  LEFT HAND:          RIGHT HAND:"
730 PRINT"     MUSIC               MUSIC"
740 PRINT"Channel:";I%;"          Channel:";B%;"
750 PRINT"Octave :";J%;"          Octave :";C%;"
760 PRINT"Volume :";L%;"          Volume :";D%;"
770 PRINT"     PLAY                PLAY"
780 PRINT"Tone enable:";M%;"      Tone enable:";E%;"
790 PRINT"Noise enable:";N%;"     Noise enable:";F%;"
800 PRINT"Envelope mode:";O%;"    Envelope mode:";G%;"
810 PRINT"Envelope period:     Envelope period:"
820 PRINT"    ";P%;"                  ";H%;"
830 PRINT
840 PRINT"To return to the first page press 0."
850 IFK$="0"THENCLEAR:PLAY0,0,0,0:GOTO40
860 PRINT"To turn the sound off press SPACE."
870 PRINT"To change values press A."
871 PRINT"To stop the program press W."
872 PRINT"The right hand plays Y-J."
873 PRINT"The left hand plays Z-M."
875 K$=KEY$
880 IFK$="Y"THENMUSICB%,C%,1,D%
890 IFK$="U"THENMUSICB%,C%,3,D%
900 IFK$="I"THENMUSICB%,C%,5,D%
910 IFK$="O"THENMUSICB%,C%,6,D%
920 IFK$="P"THENMUSICB%,C%,8,D%
930 IFK$="["THENMUSICB%,C%,10,D%
940 IFK$="J"THENMUSICB%,C%,12,D%
950 PLAYE%,F%,G%,H%
960 IFK$="Z"THENMUSICI%,J%,1,L%
970 IFK$="X"THENMUSICI%,J%,3,L%
980 IFK$="C"THENMUSICI%,J%,5,L%
990 IFK$="V"THENMUSICI%,J%,6,L%
1000 IFK$="B"THENMUSICI%,J%,8,L%
1010 IFK$="N"THENMUSICI%,J%,10,L%
1020 IFK$="M"THENMUSICI%,J%,12,L%
1030 PLAYM%,N%,O%,P%
1040 IFK$=" "THENPLAY0,0,0,0:CLEAR
1050 IFK$="A"THENPLAY0,0,0,0:CLEAR:GOTO290
1060 IFK$="Q"THENPLAY0,0,0,0:CLEAR:GOTO40
1070 IFK$="W"THENCLEAR:CLS:PLAY0,0,0,0:END
1080 GOTO875
```

3-D graph plotter

Ian Brissenden,
Swansea,
West Glamorgan.

SPECTRUM

THIS PROGRAM FOR THE 48K Spectrum plots a three-dimensional graph of a function defined at line 1, hence this is the only line that needs alteration for a different function. By choosing different options the type of display can be carried as shown on the printout, and the sides of the section can be inked in if desired. The functions shown on the printout are:

```
1 DEF FN a(x,y) = .7*(sin(x/5)*1.5) ↑4*
(sin(y/5)*1.5↑4
```

Choosing squares and a density of .75

```
1 DEF FN a(x,y) = (sin(x/3)*2) ↑3+
(sin(y/3)*2)↑3
```

Choosing double lines and density .5. Press L for lines and answer N to Single Lines ?

```
1 DEF FN a(x,y) = 2*sin(x) + .08*(sin(x/3)*2)↑
(2*y/(x/1.6 + .00001))*(sin(y/3)*2)↑3
```

Choosing squares and density .5

```
1 DEF FN a(x,y) = 1/(cos(x)*sin(y) + 1.1)
```

Choosing single line and density .2

```
1 DEF FN a(x,y) = 1/(cos(x*.41)*sin(y) + 1.1)
```

Choosing squares and density .25

As can be seen, extemely complex functions and combinations of functions can be plotted.

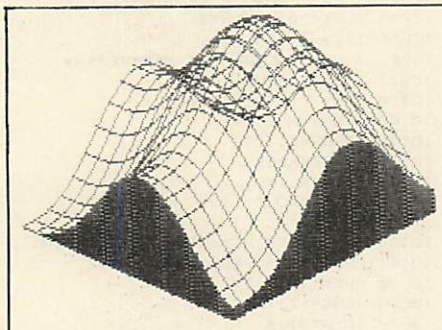
In writing this program an interesting oddity in the Spectrum's operation became apparant in the answer to

```
PRINT INT(1)
```

can be either 0 or 1 depending on what happens beforehand, for example:

```
10 FOR X=0 TO 2 STEP .5
20 PRINT X, INT(X)
30 NEXT X
```

The answer to INT(X) when X=1 is 0. However if the step in line 10 is altered to .1 then when X=1, INT(X)=1. This is why line 102 is necessary in the program, even though line 103 seems to do the same job it fails when the steps are .5 and X=1. This discrepancy occurs in every Spectrum I have tried.



```
  1 DEF FN a(x,y)=(SIN (x/3)*2)
↑3+(SIN (y/3)*2)↑3
  2 POKE 23609,100
  5 LET sq=.333333
 10 PRINT "Lines(L) or squares(
S) ?"
 11 LET l$=INKEY$: IF l$<>"l" A
ND l$<>"s" THEN GO TO 11
 15 INPUT "Density ? (Eg. .5,.2
5)";de
 16 IF l$="s" THEN LET sq=de: G
O TO 40
 20 PRINT "Single Line ? (y/n)"
 30 LET a$=INKEY$: IF a$<>"y" A
ND a$<>"n" THEN GO TO 30
 40 CLS : LET v1=15: LET v2=6:
LET v3=50
 50 INK 0: PAPER 6: BORDER 4
 70 FOR y=0 TO 8 STEP de
 80 FOR x=0 TO 8 STEP sq
100 IF x=0 THEN PLOT v1*(x+y),(
(y-x+2+FN a(x,y))*v2)+v3: GO TO
115
101 IF l$="l" THEN GO TO 105
102 IF x=1 THEN PLOT (x+y)*v1,(
(y-x+2+FN a(x,y))*v2)+v3: GO TO
115
103 IF x=INT (x) THEN PLOT (x+y
)*v1,((y-x+2+FN a(x,y))*v2)+v3:
GO TO 115
105 DRAW ((x+y)*v1)-p,((y-x+2+F
N a(x,y))*v2)+v3-q
115 LET p=v1*(x+y): LET q=((y-x
+2+FN a(x,y))*v2)+v3
120 NEXT x
121 DRAW 0,-v2*FN a(x,y)
130 NEXT y
132 IF l$="s" THEN GO TO 140
135 IF a$="y" THEN GO TO 220
140 FOR x=0 TO 8 STEP de
150 PLOT x*v1,(-v2*x+12)+v3
170 FOR y=0 TO 8 STEP sq
185 IF y=0 THEN LET s=x*v1: LET
d=(-v2*x+12)+v3: PLOT s,d: DRAW
0,(v2*(y-x+2+FN a(x,y)))+v3-d
190 IF y=0 THEN PLOT v1*(y+x),(
v2*(y-x+2+FN a(x,y)))+v3: GO TO
198
191 IF l$="l" THEN GO TO 196
193 IF y=1 THEN PLOT (v1*(y+x))
,(v2*(y-x+2+FN a(x,y)))+v3: GO T
O 198
194 IF y=INT (y) THEN PLOT (v1*
(y+x)),(v2*(y-x+2+FN a(x,y)))+v3
: GO TO 198
196 DRAW (v1*(y+x))-j,(v2*(y-x+
2+FN a(x,y)))+v3-k
198 LET j=v1*(y+x): LET k=(v2*(
y-x+2+FN a(x,y)))+v3
200 NEXT y
210 NEXT x
220 LET x=8
230 INPUT "Ink sides ? (y/n)";r
$
240 IF r$<>"y" AND r$<>"n" THEN
GO TO 230
250 IF r$="n" THEN STOP
300 FOR y=0 TO 8 STEP .05
310 PLOT (x+y)*v1,((y-x+2+FN a(
x,y))*v2)+v3
320 DRAW 0,-(v2*FN a(x,y))
330 NEXT y
340 LET y=0: FOR x=0 TO 8 STEP
.05
350 PLOT x*v1,(-v2*x+12)+v3
360 LET d=(-v2*x+12)+v3: DRAW 0
,(v2*(y-x+2+FN a(x,y)))+v3-d
370 NEXT x
```

Orbiter

Jonathan McGowan,
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DRAGON

ORBITER IS WRITTEN for the Dragon 32 and uses PMode 4 to create smooth-moving high-resolution graphics. The object is to land your space bus on the rugged terrain of your home planet because your automatic landing computer has failed. On you descent watch out for the asteroid belt above the planet — you can take a collision on the side of the bus, but if your landing gear is damaged you have had it.

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```
10 '**orbiter**J.MCGOWAN 83**
20 GOSUB 810
30 PMODE 4,1:SCREEN1,1:COLOR 5,0
40 PCLS
50 Z$="BM0,170;E20R4E4F11E4F8R10E30FBE4F20D11R12E4F15R
7E9R3E10F15R14D4R6EBE20F5R4"
60 E$="BM1,0;F8G1L1H4G3F1E1R1D1U1R1U8BR3G4H1L1H1BD3R6U
2E1R1E1BD3L2G2L2"
70 DRAW E$
80 DIM E(9,9)
90 GET (0,0)-(10,10),E,G
100 DRAW Z$
110 J$="BM4,1;D1L1D1L1D1L1D1R6U1L1U1L1U1L1D4L2R4L1D2R1
D1R2BL8R2U1R1U1R1"
120 PAINT(0,192)
130 COLOR 0,5
140 DRAW"BM0,170;D22R255U37"
150 COLOR 5,0
160 X$="BM4,1;D1L1G2D1F2R2E2U1H2BD6R1D1R2BL8R2U1R1"
170 DRAW X$
180 DIM I(9,9)
190 FUEL=252
200 DIMV(9,9)
210 GET (0,0)-(10,10),I,G
220 PUT(0,0)-(10,10),V,PSET
230 DRAW J$:GET(0,0)-(10,10),I,G:PUT(0,0)-(10,10),V,PS
ET
```

(continued on page 223)

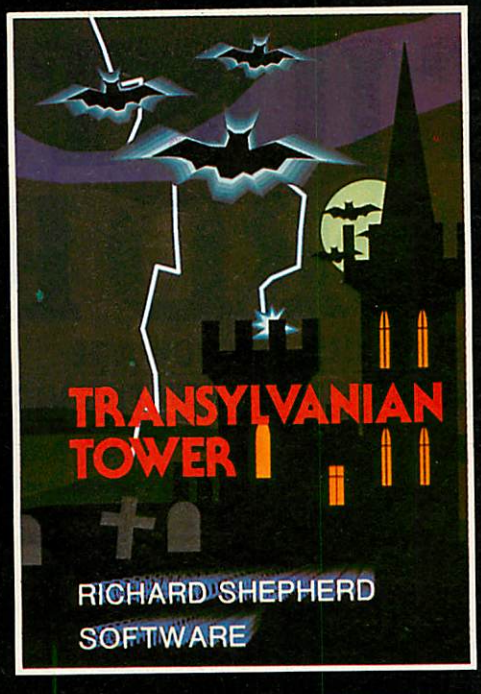
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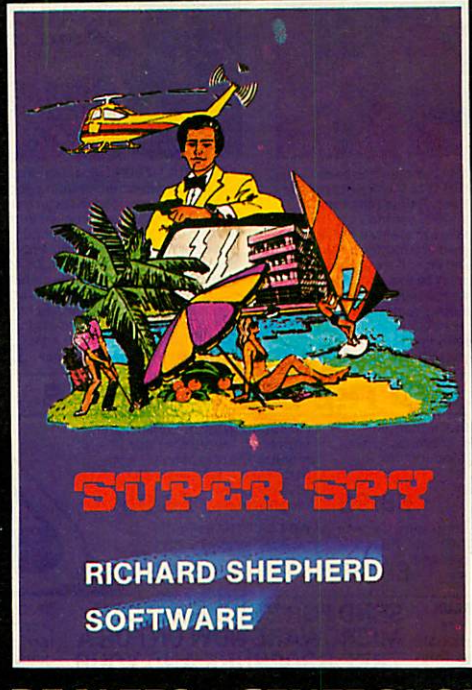
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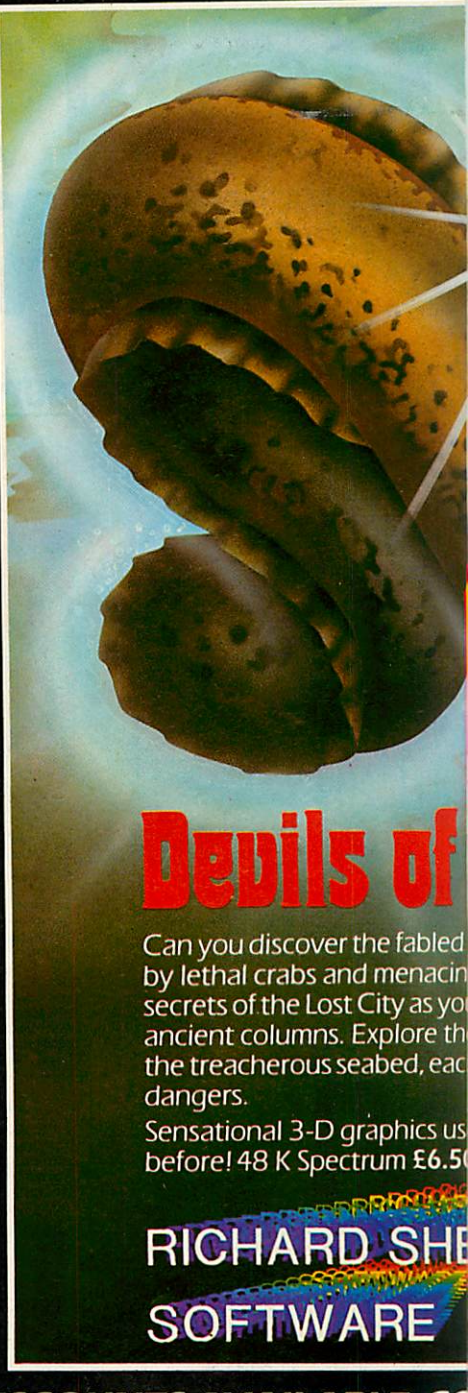


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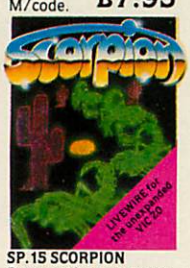
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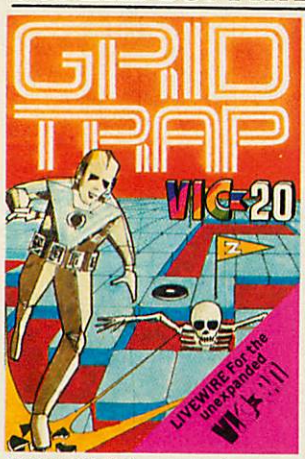
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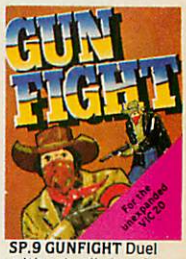
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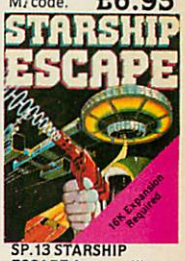
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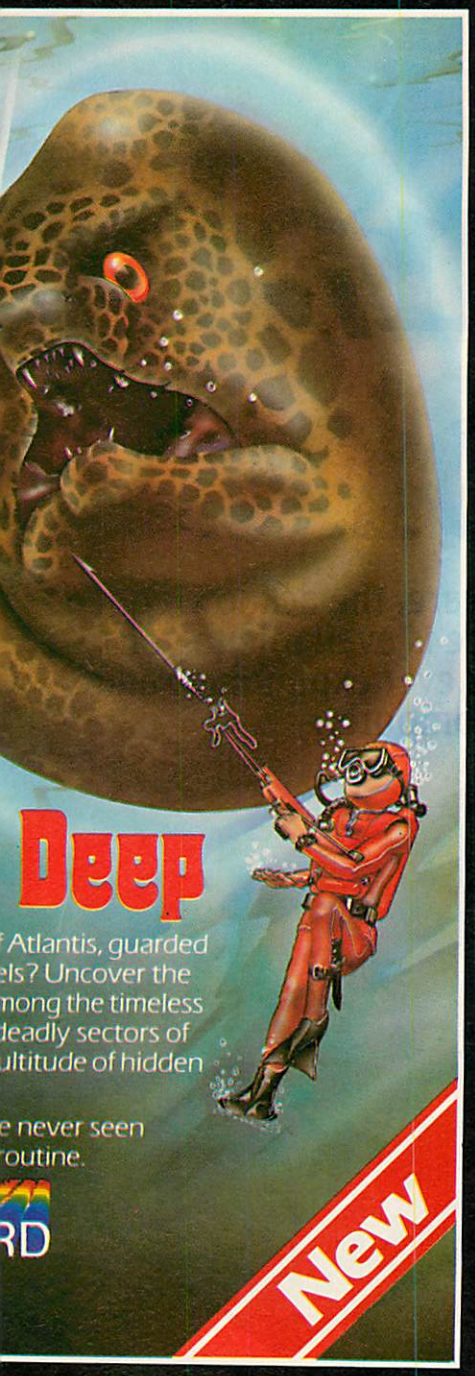
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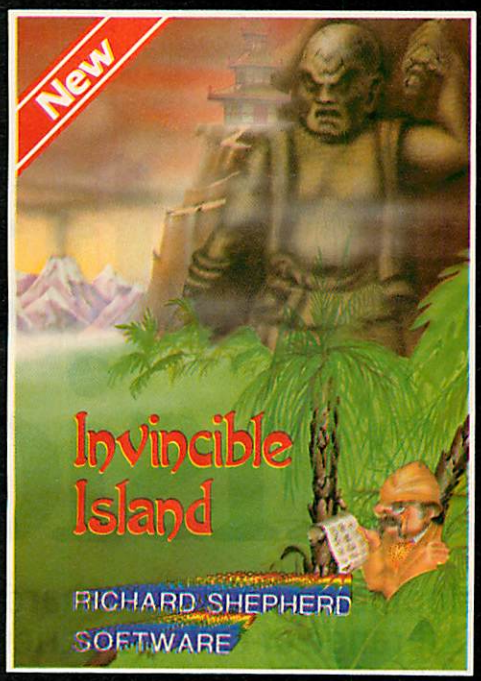
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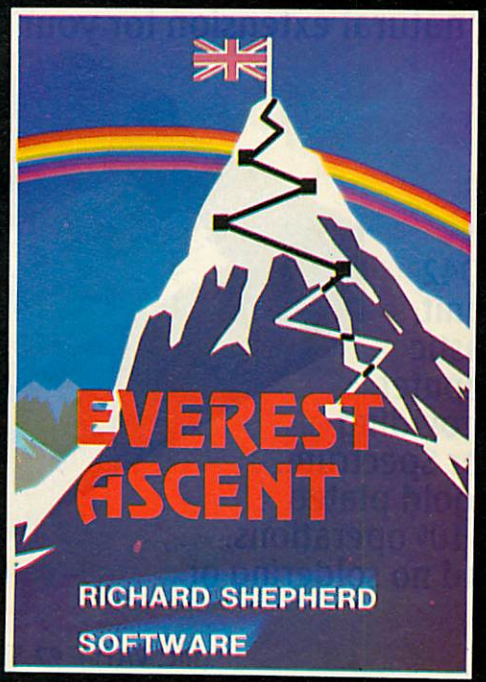




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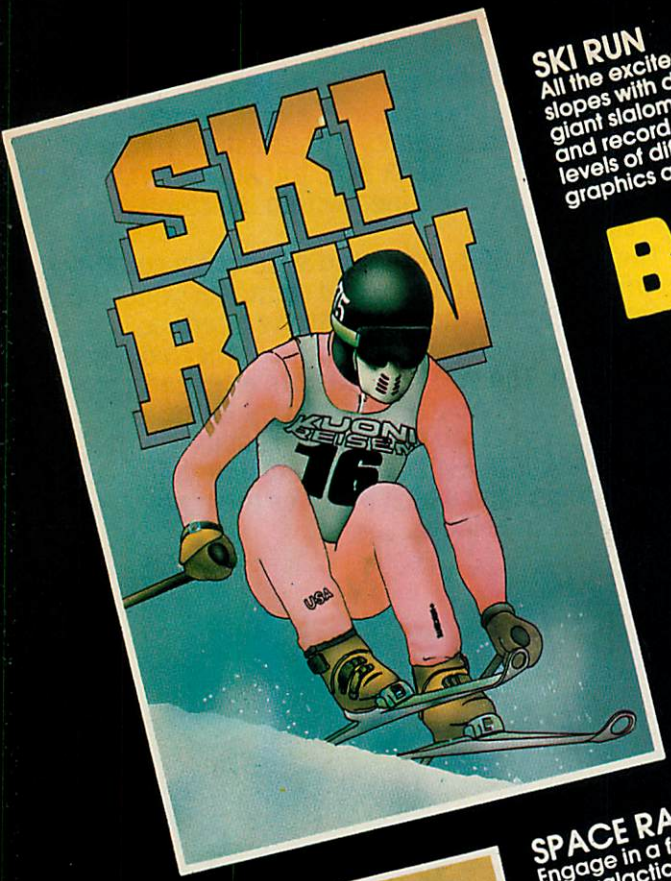
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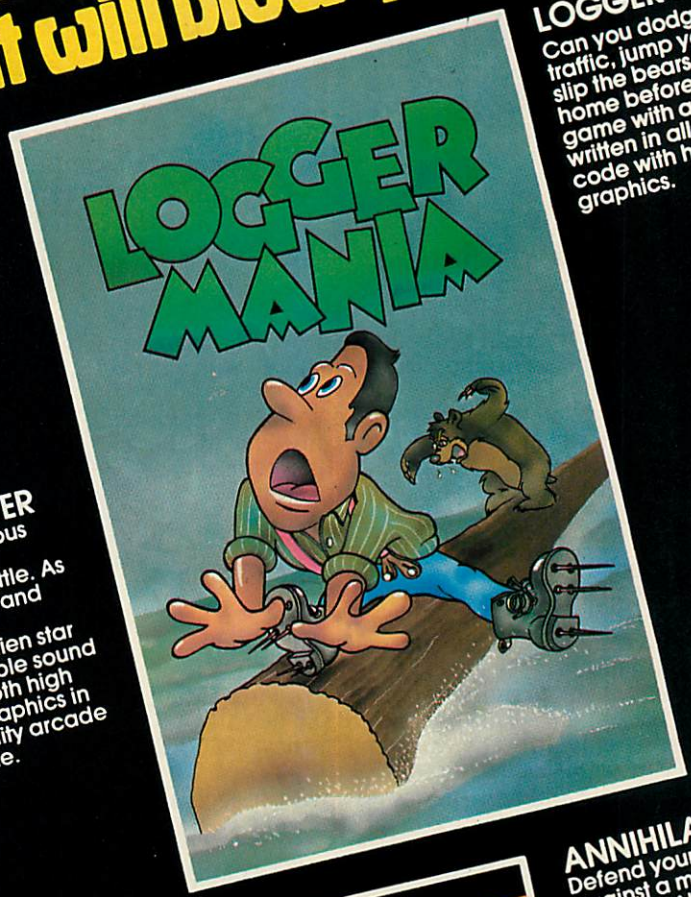
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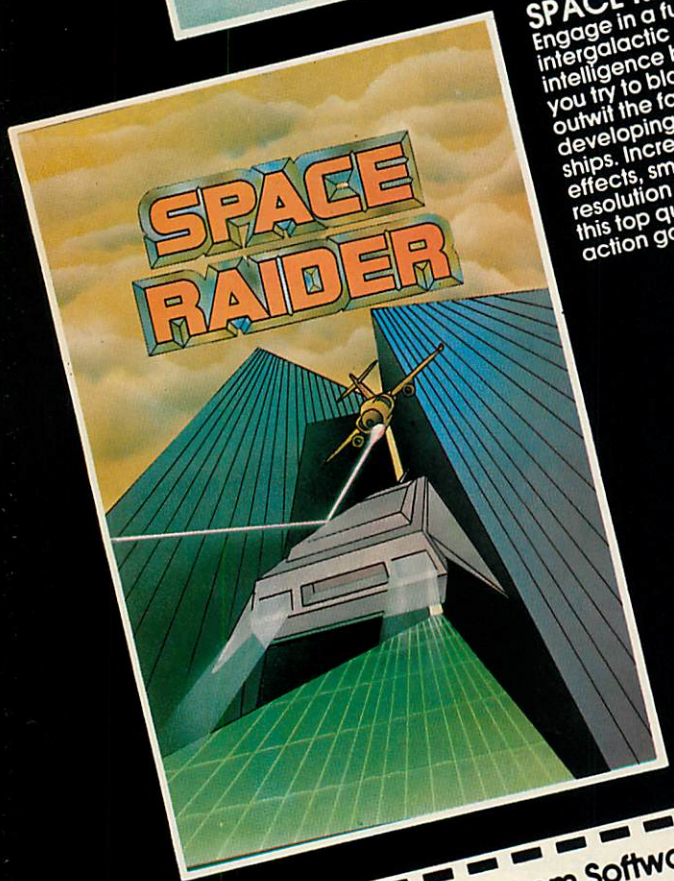
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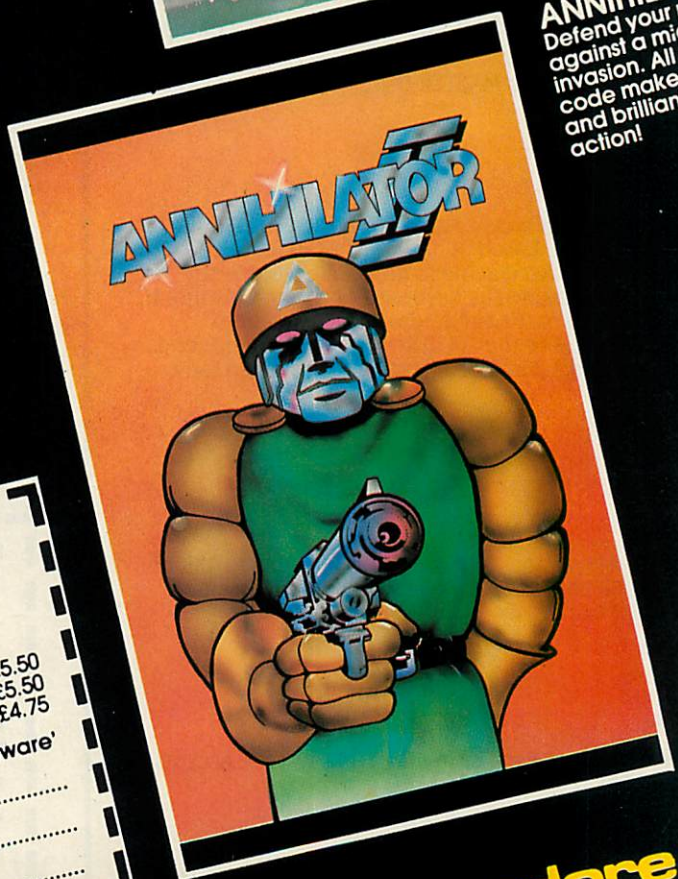
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commodore 64 and VIC 20

(continued from page 216)

```
240 DRAW"BM1,1;D6U3R1BU3R1BR2D6R2U6BR2R2L2D3R1L1D3R2BR
2R2L2U6"
250 DRAW"BM18,1;R236D6L236U6":LINE(20,3)-(FU,5),PSET,B
F
260 FOR C=0 TO 10
270 X=RND(245):Y=RND(110)+8
280 DRAW"BM"+STR$(X)+","+STR$(Y)+";BR2R2F2D2G2L2H2U2E2
"
290 NEXT C
300 COLOR 0,5
310 LINE(51,162)-(61,162),PSET
320 LINE(124,167)-(135,167),PSET
330 LINE(198,174)-(212,174),PSET
340 COLOR 5,0
350 X=230:Y=9
360 S=5
370 W=1
380 FOR N=0 TO S
390 GOTO 520
400 A$=INKEY$:IFA$<>""THEN GOSUB460
410 NEXT N
420 Y=Y+1
430 S=S-1
440 IF S<0THEN S=0
450 GOTO 380
460 IF FU=19 THEN RETURN
470 IF A$="A"THEN S=S+1:IFS=1THENS=2
480 IFS>10 THEN S=10
490 IF A$="S" THEN W=W-.1:IF W<0THEN W=0
500 LINE(FU,3)-(FU,5),PRESET:FU=FU-1
510 RETURN
520 IF A$<>"S"THENW=W+.05
530 IF W>1 THEN W=1
540 X=X-W
550 IF X<1 THEN PUT(X,Y)-(X+10,Y+10),V,PSET:X=244
560 IF PPOINT(X,Y+10)=5 OR PPOINT(X+8,Y+10) =5 THEN 59
0
570 PUT(X,Y)-(X+10,Y+10),I,PSET
580 GOTO 400
590 X=INT(X):Y=INT(Y)
600 IFY=152 OR Y=151 OR Y=156 OR Y=163 THEN 610 ELSE 6
20
610 IF X=50 OR X=51 OR X=124 OR X=125 OR(X>197 AND X<2
03)THEN 720 ELSE 620
620 R$="YOU CRASHED! -ALL YOUR            PASSENGERS AND
 CREW WERE KILLED."
630 PUT(X,Y)-(X+10,Y+10),E,PSET
640 PLAY"T25501"
650 FOR V=31 TO 0 STEP-1
660 PLAY"V"+STR$(V)+"DACGEBFDA"
670 NEXT V
680 SCREEN0,0
690 CLS
700 PRINTR$
710 GOTO 780
720 IF S<4 THEN R$="YOU CRASH LANDED.YOU WERE        DE
SCENDING TOO FAST.":GOTO 630
730 FOR N=0 TO 2000:NEXT
740 SCREEN0,0
750 CLS
760 PRINT"WELL DONE.YOU MANAGED TO SAFELY LAND YOUR BU
S ON THE PLANET."
770 PRINT:PRINT"YOU HAD"FU-19"UNITS OF FUEL LEFT"
780 FOR N=0 TO 2500:NEXT
790 PRINT:PRINT:INPUT"WOULD YOU LIKE TO TRY AGAIN";P$:
IF P$="Y"THEN RUN
800 CLS:END
810 CLS3
820 PRINT@0,STRING$(13,153);"orbiter";STRING$(12,150);
830 PRINT@65,"AFTER RETURNING FROM A DAY";
840 PRINT@97,"TRIP TO NEPTUNE,YOU,THE";
850 PRINT@129,"COMMANDER OF THE SPACE BUS";
860 PRINT@161,"REALISE THAT THE AUTOMATIC";
870 PRINT@193,"LANDING COMPUTER HAS FAILED,";
880 PRINT@225,"AND THAT YOU MUST LAND THE";
890 PRINT@257,"BUS MANUALLY ON YOUR HOME";
900 PRINT@289,"PLANET ,SATURN";
910 PRINT@353,"YOUR MAIN COMPUTER INDICATES";
920 PRINT@385,"HIGH CROSS WIND ABOVE THE";
930 PRINT@417,"PLANET AND THAT YOU ARE LOW ON";
940 PRINT@449,"FUEL.";
950 PRINT@488,"PRESS A KEY";
960 SCREEN 0,1
970 IF INKEY$=""THEN970
980 CLS6
990 PRINT@33,"THERE ARE ONLY 3 PLACES WHICH";
1000 PRINT@65,"YOU CAN LAND YOUR BUS.ALSO";
1010 PRINT@97,"BEWARE THE ASTEROID BELT.DO NOT";
1020 PRINT@129,"DAMAGE YOUR LANDING GEAR BY";
1030 PRINT@161,"HITTING AN ASTEROID";
1040 PRINT@230,"YOUR CONTROLS ARE:";
1050 PRINT@294,"a=THRUST AGAINST GRAVITY";
1060 PRINT@326,"s=THRUST AGAINST WIND";
1070 PRINT@390,"press a key";
1080 IF INKEY$=""THEN1080
1090 RETURN
```

Letter puzzle

David Griffin,
Warley,
West Midlands.

BBC

AFTER RECEIVING the new user guide for my BBC, I was impressed by the large amount of documentation about the operating system. Many of the routines seem to be very useful, and will make life a lot easier when writing both Basic and machine-code programs.

One routine which caught my eye was Osword which gives the user access to several different operations needing more parameters than can be passed in the usual X, Y and A registers — X%, Y% and A% in Basic, e.g., defining an envelope or reading a pixel. Therefore a parameter block must be set up somewhere in memory. One call in this routine, I found of particular interest, is reading a character definition.

Definition of character

Osword is called at &fff1 and is indirected through &20c. To obtain the definition of a character, the Accumulator must be equal to &0a on entry, and the X and Y registers point to a block of memory, where

X = address MOD 256
Y = address DIV 256

e.g., if the address of the parameter block is &c00

X = &c00 MOD 256 = &00
Y = &c00 DIV 256 = &0c

On entry the memory location XY must contain the ASCII code of the character for which the definition must be read, and on exit the bit pattern will be stored in the following eight bytes.

That is, in the above example, if the definition of the letter A is required, on exit

&c00 . . . 65
&c01 . . . Top row of A
&c01 . . . Second row
.
.
&c08 . . . Bottom row of A

This game makes use of the routine to print double-height characters in Mode 2. It simulates one of those plastic puzzles in which discs are moved around a grid until they form the correct sequence.

Your object is to rearrange the letters A to O in correct alphabetical order. Use the cursor keys to move the squares into an empty space.

```
  10 REM    ** Program 4
  20 REM"  **Letter Puzzle**
  30 REM"(c) David Griffin 1983
  40 PROCSET
  50 MODE 7
  60 PROCINSTR
  70 PROCINIT(GAM)
  80 MODE 2
  90 VDU 23;8202;0;0;0;
 100 VDU 19,0,4,0,0,0
 110 PROCINITSC
 120 PROCBORDER
 130 PROCIDRAW
 140 IF GAM=0 PROCMIX(SKILL)
 150 *FX 11 0
 160 *FX 4,1
 170 MV=-1
 180 PROCDRAWM
 190 TEST=0
 200 PROCKEY
 210 PROCMOVE
 220 PROCDRAWM
 230 PROCCHECK
 240 IF CHE<>1 GOTO 200
 250 TIM=TIME
 260 REPEAT UNTIL TIME=TIM+300
 270 MODE 7
 280 PROCEND
 290 IF KEY$="Y" GOTO 50
 300 *FX 4,0
 310 *FX 11 50
 320 PRINT ''
 330 END
 340 DEFPROCKEY
 350 IF TEST=0 REPEAT KEY=INKEY 0:UNTIL KEY<140 AND K
EY>135 ELSE KEY=RND(4)+135
 360 IF (KEY=136 AND SPX=4) OR (KEY=137 AND SPX=1) OR
(KEY=138 AND SPY=1) OR (KEY=139 AND SPY=4) GOTO 350
 370 IF TEST=0 SOUND 1,1,RND(30),10
 380 DX=0
 390 DY=0
 400 IF KEY=136 DX=-1
 410 IF KEY=137 DX=1
 420 IF KEY=138 DY=1
 430 IF KEY=139 DY=-1
 440 ENDPROC
 450 DEFPROCMOVE
 460 T$=P$(SPX-DX,SPY-DY)
 470 P$(SPX-DX,SPY-DY)="0"
 480 P$(SPX,SPY)=T$
 490 VDU 31,SPX*3+1,SPY*4+1
 500 PROCVDU(ASC(T$))
 510 SPX=SPX-DX
 520 SPY=SPY-DY
 530 VDU 31,SPX*3+1,SPY*4+1
 540 PROCSPACE
 550 ENDPROC
 560 DEFPROCDRAWM
 570 MV=MV+1
 580 COLOUR 131
 590 COLOUR 2
 600 PRINT TAB(5,25);"No. of";TAB(5,26);"moves = ";MV
;TAB(5,27);"so far"
 610 COLOUR 128
 620 COLOUR 7
 630 ENDPROC
 640 DEFPROCCHECK
 650 RESTORE 1870
 660 CHE=1
 670 FOR I%=1 TO 4
 680 FOR J%=1 TO 4
 690 READ K$
 700 IF K$<>P$(J%,I%) CHE=0
 710 NEXT,
 720 ENDPROC
 730 DEFPROCMIX(NNN)
 740 TEST=1
 750 FOR I=1 TO NNN
 760 PROCKEY
 770 PROCMOVE
 780 FOR DEL=1 TO 100
 790 NEXT
 800 NEXT
 810 ENDPROC
 820 DEFPROCINSTR
 830 PROCTITL
 840 FOR II=9 TO 10
 850 VDU 31,0,II,141,134
 860 PRINT "Do you want instructions ? (Y/N) ... ";
 870 NEXT
 880 PROCKY("YN")
 890 IF KEY$="N" GOTO 970
 900 VDU 28,0,22,39,3,12,26
 910 VDU 31,0,4:PRINT "   This game is a simulation o
f one of  those plastic puzzles in which discs aremove
d around a grid until they are      replaced in sequen
ce."
 920 PRINT '"   The object of the game is to
rearrange the letters A-O, in correct  alphabetic ord
er."
 930 PRINT '"   Use the cursor-control keys to move
the squares in the respective direction into the empty
 space."
 940 VDU 10,10,10,136,130
 950 PRINT"          PRESS 'SPACE BAR'";
 960 PROCKY(" ")
 970 VDU 28,0,22,39,3,12,26
 980 SKILL=0
 990 GAM=0
1000 PRINT TAB(0,6);"   Do you want to use a pre-defi
ned     position ? (Y/N) ... ";
1010 PROCKY("YN")
1020 PRINT KEY$
1030 IF KEY$="Y" GOTO 1090
1040 PRINT '''"    What skill level do you want ?
 (0-9 (9 hardest)) ... ";
1050 PROCKY("0123456789")
1060 SKILL=(VAL(KEY$)+1)*20
1070 IF KEY$="0" SKILL=10
1080 ENDPROC
1090 PRINT '''"    Which pattern ? (1,2 or 3) ... ";
1100 PROCKY("123")
1110 GAM=VAL(KEY$)
1120 ENDPROC
1130 DEFPROCTITL
1140 FOR II=1 TO 2
1150 VDU 31,6,II,141,131,157,129
1160 PRINT "<< Letter Puzzle >>  ";
1170 VDU 156
1180 VDU 31,6,II+22,141,130
1190 PRINT"(c) David Griffin 1983";
1200 NEXT
1210 ENDPROC
1220 DEFPROCINITSC
1230 VDU 19,15,0,0,0,0
1240 GCOL 0,15
1250 MOVE 0,0
1260 DRAW 1280,0
1270 PLOT 85,0,1024
1280 PLOT 85,1280,1024
1290 GCOL 0,0
1300 MOVE 220,320
1310 DRAW 1050,320
1320 PLOT 85,220,900
1330 PLOT 85,1050,900
1340 TI$="* Letter Puzzle *"
1350 VDU 5
1360 GCOL 0,6
1370 FOR II=1 TO LEN TI$
1380 PROCDBL(ASC(MID$(TI$,II,1)))
1390 MOVE (II)*64+32,1010
1400 VDU 254
1410 MOVE (II)*64+32,978
1420 VDU 255
1430 NEXT
1440 CC$="(c) D.Griffin 1982"
1450 GCOL 0,4
1460 FOR II=1 TO LEN CC$
1470 PROCDBL(ASC(MID$(CC$,II,1)))
1480 MOVE II*64,70
1490 VDU 254
1500 MOVE II*64,38
1510 VDU 255
1520 NEXT
1530 VDU 4
1540 GCOL 0,3
1550 MOVE 248,120
1560 DRAW 1024,120
1570 PLOT 85,248,232
1580 PLOT 85,1024,232
1590 ENDPROC
1600 DEFPROCKY(KK$)
1610 KEY$=GET$
1620 IF INSTR(KK$,KEY$)=0 SOUND 1,-15,RND(10),5:GOTO
610
1630 ENDPROC
1640 DEFPROCEND
1650 FOR II=4 TO 5
1660 VDU 31,10,II,141,131
1670 PRINT "Congratulations"
1680 VDU 31,3,II+2,141,129
1690 PRINT "You have completed the puzzle"
1700 VDU 31,7,II+4,141,130
1710 PRINT "It took you ";MV;" moves"
1720 VDU 31,0,II+15,141,133
1730 PRINT "Do you want to play again ? (Y/N) ...";
1740 NEXT
1750 PROCKY("YN")
1760 ENDPROC
1770 DEFPROCINIT(_G)
1780 RESTORE 1870
1790 IF _G=1 RESTORE 1880
1800 IF _G=2 RESTORE 1890
1810 IF _G=3 RESTORE 1900
1820 FOR I=1 TO 4
1830 FOR J=1 TO 4
1840 READ P$(J,I)
1850 IF P$(J,I)="0" SPX=J:SPY=I
1860 NEXT,
1870 DATA A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,0
1880 DATA K,F,D,A,J,B,H,O,M,I,O,L,N,E,C,G
1890 DATA O,C,H,D,A,E,F,N,I,J,B,M,L,K,G,O
1900 DATA J,L,F,A,B,E,D,C,O,H,G,I,N,M,K,O
1910 ENDPROC
1920 DEFPROCVDU(_N)
1930 PROCDBL(_N)
1940 COLOUR 5
1950 VDU 240,241,242,10,8,8,8,243
1960 COLOUR 3
1970 VDU 254
1980 COLOUR 5
1990 VDU 244,10,8,8,8,243
2000 COLOUR 3
2010 VDU 255
2020 COLOUR 5
2030 VDU 244,10,8,8,8,245,246,247
2040 ENDPROC
2050 DEFPROCSPACE
2060 VDU 32,32,32,10,8,8,8,32,32,32,10,8,8,8,32,32,32
,10,8,8,8,32,32,32
2070 ENDPROC
2080 DEFPROCIDRAW
2090 VDU 4
2100 FOR X=1 TO 4
2110 FOR Y=1 TO 4
2120 VDU 31,X*3+1,Y*4+1
2130 IF P$(X,Y)="0" PROCSPACE:GOTO 2160
2140 TT=ASC(P$(X,Y))
2150 PROCVDU(TT)
2160 NEXT,
2170 ENDPROC
2180 DEFPROCBORDER
2190 GCOL 0,1
2200 FOR I=0 TO 32 STEP 4
2210 MOVE 232-I,336-I
2220 DRAW 1040+I,336-I
```

(continued on page 227)

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I have read and understood the conditions and agree to abide by them.

.....Signature

NAME:.....

ADDRESS: .....

.....

.....

.....YC1183

(continued from page 216)

```
240 DRAW"BM1,1;D6U3R1BU3R1BR2D6R2U6BR2R2L2D3R1L1D3R2BR
2R2L2U6"
250 DRAW"BM18,1;R236D6L236U6":LINE(20,3)-(FU,5),PSET,B
F
260 FOR C=0 TO 10
270 X=RND(245):Y=RND(110)+8
280 DRAW"BM"+STR$(X)+","+STR$(Y)+";BR2R2F2D2G2L2H2U2E2
"
290 NEXT C
300 COLOR 0,5
310 LINE(51,162)-(61,162),PSET
320 LINE(124,167)-(135,167),PSET
330 LINE(198,174)-(212,174),PSET
340 COLOR 5,0
350 X=230:Y=9
360 S=5
370 W=1
380 FOR N=0 TO S
390 GOTO 520
400 A#=INKEY$:IFA$<>""THEN GOSUB460
410 NEXT N
420 Y=Y+1
430 S=S-1
440 IF S<0THEN S=0
450 GOTO 380
460 IF FU=19 THEN RETURN
470 IF A#="A"THEN S=S+1:IFS=1THENS=2
480 IFS>10 THEN S=10
490 IF A#="S" THEN W=W-.1:IF W<0THEN W=0
500 LINE(FU,3)-(FU,5),PRESET:FU=FU-1
510 RETURN
520 IF A$<>"S"THENW=W+.05
530 IF W>1 THEN W=1
540 X=X-W
550 IF X<1 THEN PUT(X,Y)-(X+10,Y+10),V,PSET:X=244
560 IF PPOINT(X,Y+10)=5 OR PPOINT(X+8,Y+10) =5 THEN 59
0
570 PUT(X,Y)-(X+10,Y+10),I,PSET
580 GOTO 400
590 X=INT(X):Y=INT(Y)
600 IFY=152 OR Y=151 OR Y=156 OR Y=163 THEN 610 ELSE 6
20
610 IF X=50 OR X=51 OR X=124 OR X=125 OR(X>197 AND X<2
03)THEN 720 ELSE 620
620 R$="YOU CRASHED! -ALL YOUR            PASSENGERS AND
 CREW WERE KILLED."
630 PUT(X,Y)-(X+10,Y+10),E,PSET
640 PLAY"T25501"
650 FOR V=31 TO 0 STEP-1
660 PLAY"V"+STR$(V)+"DACGEBFDA"
670 NEXT V
680 SCREEN0,0
690 CLS
700 PRINTR$
710 GOTO 780
720 IF S<4 THEN R$="YOU CRASH LANDED.YOU WERE       DE
SCENDING TOO FAST.":GOTO 630
730 FOR N=0 TO 2000:NEXT
740 SCREEN0,0
750 CLS
760 PRINT"WELL DONE.YOU MANAGED TO SAFELY LAND YOUR BU
S ON THE PLANET."
770 PRINT:PRINT"YOU HAD"FU-19"UNITS OF FUEL LEFT"
780 FOR N=0 TO 2500:NEXT
790 PRINT:PRINT:INPUT"WOULD YOU LIKE TO TRY AGAIN";P$:
IF P$="Y"THEN RUN
800 CLS:END
810 CLS3
820 PRINT@0,STRING$(13,153);"orbiter";STRING$(12,150);
830 PRINT@65,"AFTER RETURNING FROM A DAY";
840 PRINT@97,"TRIP TO NEPTUNE,YOU,THE";
850 PRINT@129,"COMMANDER OF THE SPACE BUS";
860 PRINT@161,"REALISE THAT THE AUTOMATIC";
870 PRINT@193,"LANDING COMPUTER HAS FAILED.";
880 PRINT@225,"AND THAT YOU MUST LAND THE";
890 PRINT@257,"BUS MANUALLY ON YOUR HOME";
900 PRINT@289,"PLANET ,SATURN";
910 PRINT@353,"YOUR MAIN COMPUTER INDICATES";
920 PRINT@385,"HIGH CROSS WIND ABOVE THE";
930 PRINT@417,"PLANET AND THAT YOU ARE LOW ON";
940 PRINT@449,"FUEL.";
950 PRINT@488,"PRESS A KEY";
960 SCREEN 0,1
970 IF INKEY$=""THEN970
980 CLS6
990 PRINT@33,"THERE ARE ONLY 3 PLACES WHICH";
1000 PRINT@65,"YOU CAN LAND YOUR BUS.ALSO";
1010 PRINT@97,"BEWARE THE ASTEROID BELT.DO NOT";
1020 PRINT@129,"DAMAGE YOUR LANDING GEAR BY";
1030 PRINT@161,"HITTING AN ASTEROID";
1040 PRINT@230,"YOUR CONTROLS ARE:";
1050 PRINT@294,"a=THRUST AGAINST GRAVITY";
1060 PRINT@326,"s=THRUST AGAINST WIND";
1070 PRINT@390,"press a key";
1080 IF INKEY$=""THEN1080
1090 RETURN
```

Letter puzzle

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Warley,
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BBC

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One routine which caught my eye was Osword which gives the user access to several different operations needing more parameters than can be passed in the usual X, Y and A registers — X%, Y% and A% in Basic, e.g., defining an envelope or reading a pixel. Therefore a parameter block must be set up somewhere in memory. One call in this routine, I found of particular interest, is reading a character definition.

Definition of character

Osword is called at &fff1 and is indirected through &20c. To obtain the definition of a character, the Accumulator must be equal to &0a on entry, and the X and Y registers point to a block of memory, where

X = address MOD 256
Y = address DIV 256

e.g., if the address of the parameter block is &c00

X = &c00 MOD 256 = &00
Y = &c00 DIV 256 = &0c

On entry the memory location XY must contain the ASCII code of the character for which the definition must be read, and on exit the bit pattern will be stored in the following eight bytes.

That is, in the above example, if the definition of the letter A is required, on exit

&c00 . . . 65
&c01 . . . Top row of A
&c01 . . . Second row
.
.
&c08 . . . Bottom row of A

This game makes use of the routine to print double-height characters in Mode 2. It simulates one of those plastic puzzles in which discs are moved around a grid until they form the correct sequence.

Your object is to rearrange the letters A to O in correct alphabetical order. Use the cursor keys to move the squares into an empty space.

```
  10 REM    ** Program 4
  20 REM"  **Letter Puzzle**
  30 REM"(c) David Griffin 1983
  40 PROCSET
  50 MODE 7
  60 PROCINSTR
  70 PROCINIT(GAM)
  80 MODE 2
  90 VDU 23;8202;0;0;0;
 100 VDU 19,0,4,0,0,0
 110 PROCINITSC
 120 PROCBORDER
 130 PROCIDRAW
 140 IF GAM=0 PROCMIX(SKILL)
 150 *FX 11 0
 160 *FX 4,1
 170 MV=-1
 180 PROCDRAWM
 190 TEST=0
 200 PROCKEY
 210 PROCMOVE
 220 PROCDRAWM
 230 PROCCHECK
 240 IF CHE<>1 GOTO 200
 250 TIM=TIME
 260 REPEAT UNTIL TIME=TIM+300
 270 MODE 7
 280 PROCEND
 290 IF KEY$="Y" GOTO 50
 300 *FX 4,0
 310 *FX 11 50
 320 PRINT ''
 330 END
 340 DEFPROCKEY
 350 IF TEST=0 REPEAT KEY=INKEY 0:UNTIL KEY<140 AND K
EY>135 ELSE KEY=RND(4)+135
 360 IF (KEY=136 AND SPX=4) OR (KEY=137 AND SPX=1) OR
(KEY=138 AND SPY=1) OR (KEY=139 AND SPY=4) GOTO 350
 370 IF TEST=0 SOUND 1,1,RND(30),10
 380 DX=0
 390 DY=0
 400 IF KEY=136 DX=-1
 410 IF KEY=137 DX=1
 420 IF KEY=138 DY=1
 430 IF KEY=139 DY=-1
 440 ENDPROC
 450 DEFPROCMOVE
 460 T$=P$(SPX-DX,SPY-DY)
 470 P$(SPX-DX,SPY-DY)="0"
 480 P$(SPX,SPY)=T$
 490 VDU 31,SPX*3+1,SPY*4+1
 500 PROCVDU(ASC(T$))
 510 SPX=SPX-DX
 520 SPY=SPY-DY
 530 VDU 31,SPX*3+1,SPY*4+1
 540 PROCSPACE
 550 ENDPROC
 560 DEFPROCDRAWM
 570 MV=MV+1
 580 COLOUR 131
 590 COLOUR 2
 600 PRINT TAB(5,25);"No. of";TAB(5,26);"moves = ";MV
;TAB(5,27);"so far"
 610 COLOUR 128
 620 COLOUR 7
 630 ENDPROC
 640 DEFPROCCHECK
 650 RESTORE 1870
 660 CHE=1
 670 FOR I%=1 TO 4
 680 FOR J%=1 TO 4
 690 READ K$
 700 IF K$<>P$(J%,I%) CHE=0
 710 NEXT,
 720 ENDPROC
 730 DEFPROCMIX(NNN)
 740 TEST=1
 750 FOR I=1 TO NNN
 760 PROCKEY
 770 PROCMOVE
 780 FOR DEL=1 TO 100
 790 NEXT
 800 NEXT
 810 ENDPROC
 820 DEFPROCINSTR
 830 PROCTITL
 840 FOR II=9 TO 10
 850 VDU 31,0,II,141,134
 860 PRINT "Do you want instructions ? (Y/N) ... ";
 870 NEXT
 880 PROCKY("YN")
 890 IF KEY$="N" GOTO 970
 900 VDU 28,0,22,39,3,12,26
 910 VDU 31,0,4:PRINT "   This game is a simulation o
f one of  those plastic puzzles in which discs aremove
d around a grid until they are      replaced in sequen
ce."
 920 PRINT '"   The object of the game is to
rearrange the letters A-O, in correct   alphabetic ord
er."
 930 PRINT '"   Use the cursor-control keys to move
the squares in the respective direction into the empty
 space."
 940 VDU 10,10,10,136,130
 950 PRINT"          PRESS 'SPACE BAR'";
 960 PROCKY(" ")
 970 VDU 28,0,22,39,3,12,26
 980 SKILL=0
 990 GAM=0
1000 PRINT TAB(0,6);"   Do you want to use a pre-defi
ned     position ? (Y/N) ... ";
1010 PROCKY("YN")
1020 PRINT KEY$
1030 IF KEY$="Y" GOTO 1090
1040 PRINT '''"    What skill level do you want ?
  (0-9 (9 hardest)) ... ";
1050 PROCKY("0123456789")
1060 SKILL=(VAL(KEY$)+1)*20
1070 IF KEY$="0" SKILL=10
1080 ENDPROC
1090 PRINT '''"    Which pattern ? (1,2 or 3) ... ";
1100 PROCKY("123")
1110 GAM=VAL(KEY$)
1120 ENDPROC
1130 DEFPROCTITL
1140 FOR II=1 TO 2
1150 VDU 31,6,II,141,131,157,129
1160 PRINT "<< Letter Puzzle >>  ";
1170 VDU 156
1180 VDU 31,6,II+22,141,130
1190 PRINT"(c) David Griffin 1983";
1200 NEXT
1210 ENDPROC
1220 DEFPROCINITSC
1230 VDU 19,15,0,0,0,0
1240 GCOL 0,15
1250 MOVE 0,0
1260 DRAW 1280,0
1270 PLOT 85,0,1024
1280 PLOT 85,1280,1024
1290 GCOL 0,0
1300 MOVE 220,320
1310 DRAW 1050,320
1320 PLOT 85,220,900
1330 PLOT 85,1050,900
1340 TI$="* Letter Puzzle *"
1350 VDU 5
1360 GCOL 0,6
1370 FOR II=1 TO LEN TI$
1380 PROCDBL(ASC(MID$(TI$,II,1)))
1390 MOVE (II)*64+32,1010
1400 VDU 254
1410 MOVE (II)*64+32,978
1420 VDU 255
1430 NEXT
1440 CC$="(c) D.Griffin 1982"
1450 GCOL 0,4
1460 FOR II=1 TO LEN CC$
1470 PROCDBL(ASC(MID$(CC$,II,1)))
1480 MOVE II*64,70
1490 VDU 254
1500 MOVE II*64,38
1510 VDU 255
1520 NEXT
1530 VDU 4
1540 GCOL 0,3
1550 MOVE 248,120
1560 DRAW 1024,120
1570 PLOT 85,248,232
1580 PLOT 85,1024,232
1590 ENDPROC
1600 DEFPROCKY(KK$)
1610 KEY$=GET$
1620 IF INSTR(KK$,KEY$)=0 SOUND 1,-15,RND(10),5:GOTO
610
1630 ENDPROC
1640 DEFPROCEND
1650 FOR II=4 TO 5
1660 VDU 31,10,II,141,131
1670 PRINT "Congratulations"
1680 VDU 31,3,II+2,141,129
1690 PRINT "You have completed the puzzle"
1700 VDU 31,7,II+4,141,130
1710 PRINT "It took you ";MV;" moves"
1720 VDU 31,0,II+15,141,133
1730 PRINT "Do you want to play again ? (Y/N) ...";
1740 NEXT
1750 PROCKY("YN")
1760 ENDPROC
1770 DEFPROCINIT(_G)
1780 RESTORE 1870
1790 IF _G=1 RESTORE 1880
1800 IF _G=2 RESTORE 1890
1810 IF _G=3 RESTORE 1900
1820 FOR I=1 TO 4
1830 FOR J=1 TO 4
1840 READ P$(J,I)
1850 IF P$(J,I)="0" SPX=J:SPY=I
1860 NEXT,
1870 DATA A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,0
1880 DATA K,F,D,A,J,B,H,O,M,I,O,L,N,E,C,G
1890 DATA O,C,H,D,A,E,F,N,I,J,B,M,L,K,G,O
1900 DATA J,L,F,A,B,E,D,C,O,H,G,I,N,M,K,O
1910 ENDPROC
1920 DEFPROCVDU(_N)
1930 PROCDBL(_N)
1940 COLOUR 5
1950 VDU 240,241,242,10,8,8,8,243
1960 COLOUR 3
1970 VDU 254
1980 COLOUR 5
1990 VDU 244,10,8,8,8,243
2000 COLOUR 3
2010 VDU 255
2020 COLOUR 5
2030 VDU 244,10,8,8,8,245,246,247
2040 ENDPROC
2050 DEFPROCSPACE
2060 VDU 32,32,32,10,8,8,8,32,32,32,10,8,8,8,32,32,32
,10,8,8,8,32,32,32
2070 ENDPROC
2080 DEFPROCIDRAW
2090 VDU 4
2100 FOR X=1 TO 4
2110 FOR Y=1 TO 4
2120 VDU 31,X*3+1,Y*4+1
2130 IF P$(X,Y)="0" PROCSPACE:GOTO 2160
2140 TT=ASC(P$(X,Y))
2150 PROCVDU(TT)
2160 NEXT,
2170 ENDPROC
2180 DEFPROCBORDER
2190 GCOL 0,1
2200 FOR I=0 TO 32 STEP 4
2210 MOVE 232-I,336-I
2220 DRAW 1040+I,336-I
```

(continued on page 227)


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(continued from page 223)

```
2230 DRAW 1040+I,880+I
2240 DRAW 232-I,880+I
2250 DRAW 232-I,336-I
2260 NEXT
2270 ENDPROC
2280 DEFPROCSET
2290 ENVELOPE 1,0,1,-1,1,5,5,5,126,-2,-2,-2,80,20
2300 DIM P$(4,4)
2310 RESTORE 2390
2320 FOR I=240 TO 247
2330 VDU 23,I
2340 FOR J=1 TO 8
2350 READ K
2360 VDU K
2370 NEXT
2380 NEXT
2390 DATA 0,127,64,64,95,80,80,80
2400 DATA 0,255,0,0,255,0,0,0
2410 DATA 0,254,2,2,250,10,10,10
2420 DATA 80,80,80,80,80,80,80,80
2430 DATA 10,10,10,10,10,10,10,10
2440 DATA 80,80,95,64,64,127,0,0
2450 DATA 0,0,255,0,0,255,0,0
2460 DATA 10,10,250,2,2,254,0,0
2470 ENDPROC
2480 DEFPROCDBL(CHAR)
2490 ?&C00=CHAR
2500 X%=0
2510 Y%=&C
2520 A%=&0A
2530 CALL &FFF1
2540 VDU 23,254,?&C01,?&C01,?&C02,?&C02,?&C03,?&C03,?
&C04,?&C04
2550 VDU 23,255,?&C05,?&C05,?&C06,?&C06,?&C07,?&C07,?
&C08,?&C08
2560 ENDPROC
```

Auto line numbering

Gerard Daly,
Cork,
Eire.

VIC-20

AUTOMATIC LINE numbering is a 111-byte machine-code routine which allows easy entry of programs. Once this program is Entered, Saved and Run, the operator need only depress the space-bar with the cursor at the beginning of a new line, and the appropriate line number will appear. The advantage of this is that the line number does not appear automatically as soon as a carriage-return is received.

Thus additional tasks can be accomplished while programming without disturbing the routine. Line numbering begins at line 10 and increments in units of 10. Should the programmer produce a line number exceeding 65530, the legend ?Syntax Error will be displayed. The routine is entered via a Basic program. It is stored from locations 7500 and 7610 decimal and protects itself by lowering the top of memory to 7500.

At most, the line number can only consist of five digits. Thus it was ideal to store these digits from locations 0-4. Since the ASCII value of 0 is 48 and that of 1 is 49, the initial section of the program stores 49 in location 1 and 48 in the remaining location i.e.,

Location	4	3	2	1	0	
Value	48	48	48	49	48	
Line number	0	0	0	1	0	=10

The next task is to set the interrupt vector — locations 788,789 — to 7533 and to lower the top-of-memory pointer — locations 55,56 — to 7500. Following this is a routine to check both cursor position and depression of the space-bar. First, location 211 contains a 1 only if the cursor lies at the beginning of the line. The contents of location 197 will be 32 if the space-bar is pressed. Immediately following this is a routine to establish the number of digits to be printed e.g., 2 if the line-number is 10, 3 if the number is 100.

The number of digits is stored in location 198 and the digits themselves have their ASCII values stored in the keyboard queue — locations 631 to 640. Location 198 is then incremented and the value of 32 placed in the keyboard queue so that a space appears after the line number.

Finally, the line number is incremented by 10. The contents of location 1 are always incremented and following this the contents of locations 0 to 4 are checked systematically. If a location contains the ASCII value of a 9, then the value of a 0 will replace it and the subsequent location will be increased. The final three bytes of the routine involve a jump to location 60095 decimal in ROM, and the line number will finally be printed.

Remember:

- SYS (7500) to begin the routine, and the first line number will be 10.
- SYS (4096) or any location containing 0 or even Run-Stop Restore will interrupt the routine.
- SYS (7514) will resume the routine and will continue with the line-number subsequent to that number last used before the routine was interrupted.

```
10 DATA 169,48,133,0,133,2,133,3
20 DATA 133,4,169,49,133,1,120,169
30 DATA 109,141,20,3,169,29,141,21
40 DATA 3,88,133,56,169,76,133,55
50 DATA 96,165,211,201,1,208,6,169
60 DATA 32,197,197,240,3,76,191,234
70 DATA 169,0,133,211,169,48,162,4
80 DATA 213,0,208,5,202,224,255,208
90 DATA 247,232,134,198,160,0,136,181
100 DATA 0,153,119,2,200,202,224,255
110 DATA 208,245,230,198,169,32,153,119
120 DATA 2,162,1,246,0,169,58,213
130 DATA 0,208,9,169,48,149,0,232
140 DATA 224,5,208,239,76,191,234
150 Z=0
160 FOR X=7500 TO 7610
170 READ Y:Z = Z + Y:POKEX,Y
180 NEXT X
190 IF Z<>13823 THEN PRINT "ERROR IN DATA
 - PLEASE RE-ENTER":END
200 REM ** SYS (7500) TO START **
210 REM ** SYS (4096) OR RUN-STOP/RESTORE
 TO END
220 REM ** SYS (7514) TO RESUME **
230 SYS (7500)
240 NEW
```

AutoRem

Andy Scott,
Stockport,
Cheshire.

ZX-81

TO STORE MACHINE-CODE routines on the ZX-81, the usual method is to create a Rem statement at the beginning of a Basic program containing a number of characters corresponding to the length of the machine code. For large machine-code routines this can be tedious.

The short machine-code program described here will automatically create a Rem statement of the correct length. The routine will be stored above RAMtop and uses 54 bytes, plus two bytes to store the size of the Rem. Since no absolute address calls within itself are used it can, in fact, be located anywhere.

First type in listing 1. To load the hexadecimal code RUN 100 (N/L). Input the code from listing 2 either as single bytes e.g., Ed plus N/L or as multiple bytes e.g., ED4BFE7FC521 plus N/L. Always enter each byte as two digits — e.g., 06 and not 6. On completion of the loading, enter S plus N/L. Now delete lines 100 onwards and Save on tape.

To use the program, RAMtop will have to be lowered to accommodate the routine. Assuming a 16K ZX-81 and it is to be stored at the top of RAM:

POKE 16388,200 (N/L)
POKE 16389,127 (N/L)
NEW (N/L)

Now load your previously Saved program and Run. This will relocate the machine code to above RAMtop. NEW can be performed now if it is wished.

Locations 32766 and 32767 — the top two bytes of the machine code — are used to store the amount of memory that is required in the AutoRem statement — low byte and high byte

(continued on page 229)

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respectively. These can either be Poked with the correct number or the short program in listing 3 can be used.

To enable the AutoRem to work, at least one Basic line must be present before using it — e.g., 10 REM. This may later be deleted of course.

To operate AutoRem, after having initiated 32766/7,

RAND USR 32712

Now list. A new line 0 has been created with the correct number of locations within the Rem — these are filled with 0.

Changes must be made

If another area is to be used to store listing 2, changes will have to be made to RAMtop, to line 30 in listing 1 and lines 60 and 70 in listing 3. Also a different Rand USR number will be needed — this points to the first bytes of the machine code program.

If, for some reason, your created line 0 needs to be deleted, Poke 16510,1 — this changes its line number to 1 — then delete line 1. This is because it is not possible to delete a line 0.

The routine is suitable for both old and new Sinclair ROMs.

Listing 1.

```
1 REM (fill this with 54 characters)
10 FAST
20 FOR X=0 TO 53
30 POKE (32712+X),PEEK (16514+X)
40 NEXT X
50 SLOW
60 STOP
100 LET X=16514
110 LET A$=""
120IF A$="" THEN INPUT A$
130IF A$="S" THEN STOP
140 POKE X,16*CODE A$+CODE A$(2)-476
150 IF PEEK 16442<C=2 THEN SCROLL
160 PRINT X;" ";A$(1 TO 2)
170 LET X=X+1
180 LET A$=A$(3 TO )
190 GOTO 120
```

Listing 2.

```
16514  ED 4B FE 7F C5 21 06 00
16522  09 E5 C1 21 7D 40 CD 9E
16530  09 3E 76 EB 77 3E 1C C1
16538  C5 04 2B 77 0D 20 FB 05
16546  20 F8 2B 3E EA 77 D1 13
16554  13 7A 2B 77 7B 2B 77 3E
16562  00 2B 77 2B 77 C9
```

Listing 3.

```
10 PRINT "SIZE OF REM NEEDED?"
20 INPUT S
30 LET D=S/256
40 LET H=INT D
50 LET L=(D-H)*256
60 POKE 32766,L
70 POKE 32767,H
```

Shape

A R Billingham,
Gwynedd,
North Wales.

DRAGON

SHAPE IS A UTILITY program allowing shapes or shape tables to be designed and Saved for use in other programs.

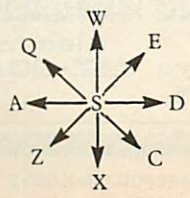
S — changes background colour (0 to 1)
B — changes background colour (0–1)
Keys: 1 to 8 scale drawing.
U — undraw last line.
O — out/input table to tape.
P — show shapes drawn so far.
Space — finished prsent shape — store and prepare next.

These files are Saved using the
OPEN "O", #-1, NM$
PRINT #-1, SH
and can be loaded into other programs using the following routine

```
1000 OPEN "I", #-1, MN$
1010 IF EOF (-1) THEN CLOSE #-1:RETURN
1020 INPUT #-1, SH$(I)
1030 I=I+1
1040 GOTO 1010
```

with an array SH$(N) ready to accept the shapes

Keys are:




```
10 CLEAR2000.
20 PCLEAR4
30 S=1
40 DIM SH$(100)
50 FOR I=0 TO 100
60 SH$(I)="CO"
70 NEXT I
80 REM *** SCREEN ***
90 PMODE 4,1
100 SCREEN 1,1
110 PCLS(BG)
120 I=0
130 IF LEN(SH$(I))<3THEN PS=I:GOTO160
140 I=I+1:GOTO130
150 PCLS(BG)
160 DRAW"BM126,90;S"+STR$(2*S)+SH$(PS)
170 Q$=INKEY$
180 GOSUB 880
190 IF Q$=""THEN170
200 IF Q$>"0"AND Q$<"9"THEN S=VAL(Q$)
210 IF Q$="P"THEN GOSUB 780
220 IF Q$="B"THEN BG=ABS(BG-1):PCLS(BG)
230 M$=""
240 OM=D
250 IF Q$="Q"THEN M$="H1":D=0
260 IF Q$="W"THEN M$="U1":D=1
270 IF Q$="E"THEN M$="E1":D=2
280 IF Q$="A"THEN M$="L1":D=3
290 IF Q$="S"THEN C=ABS(C-1):SH$(PS)=SH$(PS)+"C"+MID$(
(STR$(C)),2,1)
300 IF Q$="D" THEN M$="R1":D=4
310 IF Q$="Z"THEN M$="G1":D=5
320 IF Q$="X" THEN M$="D1":D=6
330 IF Q$="C" THEN M$="F1":D=7
340 IF M$<>""THEN GOSUB 490
350 IF Q$="U"THEN GOSUB 390
360 IF Q$=" "THEN 80
370 IF Q$="O"THEN GOSUB 560
380 GOTO 150
390 REM *** ERASE LAST ***
400 IF LEN(SH$(PS))<3THEN RETURN
410 L$=RIGHT$(SH$(PS),2)
420 AM$=MID$(L$,2,1)
430 TP$=MID$(L$,1,1)
440 IF VAL(AM$)=1 THEN SH$(PS)=LEFT$(SH$(PS),LEN(SH$(P
S))-2):RETURN
450 V=VAL(RIGHT$(SH$(PS),1))
460 V=V-1:L$=LEFT$(SH$(PS),LEN(SH$(PS))-1)
470 SH$(PS)=L$+RIGHT$(STR$(V),1)
480 RETURN
490 REM *** APPEND ***
500 IF MID$(SH$(PS),LEN(SH$(PS))-1,1)="C"THEN SH$(PS)=
SH$(PS)+M$:RETURN
510 IF D<>OM THEN SH$(PS)=SH$(PS)+M$:RETURN
520 V=VAL(RIGHT$(SH$(PS),1))
530 IF V=9 THENSH$(PS)=SH$(PS)+M$:RETURN
540 V=V+1
550 SH$(PS)=LEFT$(SH$(PS),LEN(SH$(PS))-1)+MID$(STR$(V)
,2,1):RETURN
560 CLS
570 PRINT"SAVE OR LOAD (S/L)"
580 PRINT:PRINT:PRINT:PRINT:K$=INKEY$
590 IF K$=""THEN 560
600 IF K$="S"THEN 610 ELSE 700
610 INPUT" WHAT NAME TO SAVE";NM$
620 OPEN"O",£-1,NM$
630 I=0
640 IF SH$(I)="CO"THEN 680
650 PRINT£-1,SH$(I)
660 I=I+1
670 GOTO640
680 CLOSE£-1
690 PMODE 4,1:SCREEN1,1:RETURN
700 INPUT"NAME OF FILE TO LOAD";NM$
710 OPEN"I",£-1,NM$
720 I=0
730 IF EOF(-1) THEN 770
740 INPUT£-1,SH$(I)
750 I=I+1
760 GOTO 730
770 CLOSE£-1:PMODE4,1:SCREEN1,1:RETURN
780 PCLS(BG)
790 I=0
800 X=10:Y=30
810 IF SH$(I)="CO"THEN 860
820 DRAW"S4;BM"+STR$(X)+","+STR$(Y)+SH$(I)
830 I=I+1:X=X+30
840 IFX>240 THEN X=10:Y=Y+30
850 GOTO810
860 H$=INKEY$:IF H$=""THEN860
870 RETURN
880 COLOR ABS(BG-1),C
890 LINE(5,170)-(25,190),PSET,B
900 IF D=1 THEN LINE(15,170)-(15,180),PSET
910 IF D=2 THEN LINE(25,170)-(15,180),PSET
920 IF D=4 THEN LINE(25,180)-(15,180),PSET
930 IF D=7 THEN LINE(25,190)-(15,180),PSET
940 IF D=6 THEN LINE(15,190)-(15,180),PSET
950 IF D=5 THEN LINE(5,190)-(15,180),PSET
960 IF D=3 THEN LINE(5,180)-(15,180),PSET
970 IF D=0 THEN LINE(5,170)-(15,180),PSET
980 RETURN
```

Compactor

Julian Wood,
Downham Market,
Norfolk.

SPECTRUM

IF YOU HAVE EVER been typing in a program and suddenly run out of memory, you will find this compactor program very useful. The program, for either ZX Spectrum, compacts almost any Basic program. A typical 48K program is shortened by about 7K. It normally shortens a program by about 15 percent of its original size, but this depends on how many numbers there are in the program.

Changing each number

The compactor works by changing each number in a program to its Val equivalent. For example, the number 255 would be changed to

(continued on page 231)



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(continued from page 229)

Val"255". This way, each number is shortened by three bytes, as the need for a CHR$ 14 and the following five bytes is eliminated.

Program is shortened

Because the program is shortened, all the memory from the shortened number up to Eline has to be shifted down every time a number is shortened. Also, the system variables Vars and Eline have to be altered.

Loading the Computer

The compactor does not affect variables, but it is advisable to Clear any present, before calling the compactor, as this makes the compaction process faster. As it is essential for the compactor to be short — because it is used when memory is short — it was decided not to include other compaction techniques, such as Not Pi for 0, as this would increase the length of the compactor program. As it is, the compactor occupies only 122 bytes.

The compactor is listed in figure 1. To load it, use the loader program listed in figure 2. Run it, and enter the address at which you want the compactor to be loaded. Then enter the decimal numbers in figure 1. If you make a mistake, enter 0 and re-enter the number. It is advisable to Save the routine before running it, using

SAVE"COMPACTOR" CODE ADDRESS, 122.

To use the compactor, enter Rand USR address, when you have a Basic program in memory.

Figure 1.

```
42  83  92  43  237
75  75  92  35  167
237  66  9  200  35
35  78  35  70  229
35  126  254  13  32
3  209  24  231  254
14  32  243  209  213
11  11  11  197  120
18  27  121  18  229
43  126  254  47  40
10  254  46  56  15
254  196  40  4  254
58  48  7  35  35
119  43  43  24  231
35  54  176  35  54
34  225  35  35  54
34  35  84  93  213
35  35  35  229  42
80  92  167  237  82
68  77  225  237  176
42  75  92  43  43
43  34  75  92  42
89  92  43  43  43
34  89  92  225  193
24  155  0  0  0
```

Figure 2.

```
10 INPUT "Address? ";address
20 FOR a=address TO address+12
1
30 INPUT b
40 PRINT a,b: POKE a,b
50 NEXT a
```

Byte transfer

Joel Baker,
Jerusalem,
Israel.

SPECTRUM

THIS PROGRAM CAN BE merged into a normal Basic program and once it is Run it will transfer bytes from the user-defined graphics or any machine-code program into one long data statement. The program is extremely useful for storing machine code, or for saving space. For instance, usually when creating user-defined graphics a programmer enters data using the BIN function, but once entered this method consumes a lot of RAM, so by running this program you can conserve memory.

```
   1 DATA (followed by 1540 As)
9000 LET G=23760: INPUT "FROM:";
F;" TO:";T: FOR V=F TO T
9010 LET P=PEEK V: FOR H=1 TO LE
N STR$ P: POKE G,CODE ((STR$ P)(
H)): LET G=G+1: NEXT H: POKE G,1
4: POKE G+1,0: POKE G+2,0: POKE
G+3,P: POKE G+4,0: POKE G+5,0: P
OKE G+6,CODE ",": LET G=G+7: NEX
T V
```

Enter the program as shown. It is important to enter all the As because these are made to hold all the data of the UDGs. Entry can be made easier by typing

POKE 23608,1

which disables the Rasp. After entering the program you should Save it and then merge it with a desired program. Type Run 9000. You will then be asked the starting location which is usually USR "A" and then you will be asked the ending location which usually is USR "U"+7. After waiting for about 30 seconds you will see the Data statement filled with numbers and there you have all the UDGs neatly Poked into line 1.

Merger

A North,
Shipley,
West Yorkshire.

DRAGON

THIS PROGRAM MERGES two to 10 Basic programs. Here is how to use your Dragon 32 Merger. First, make sure that none of the programs how overlapping line numbers, as this will cause errors — use your Renum facility. Next,

CSAVE " PROGRAM ",A

on one cassette in the order they are to appear in the final listing.

Then, CLoad and Run Merger. The program will ask for the number of programs to be merged and the name of each program in the order they are to appear. Then it will also ask the name you want the new program to be saved under in the final copy. After you have given all this information, the message Ready Cassette appears. Press the play button on the cassette recorder and press Enter. The cassette should begin alternately starting and stopping until it has loaded all of the programs: they are listed to the screen as they are loaded.

When it has finished, the computer will display New Tape. Place a new clean tape in the recorder and press Enter. The computer will tell you to press Record. Do so and press Enter again, the cassette will go on and the merged programs will be Saved as one under the new name.

```
    0 REM FOR £ READ HASH CHARACTER
    1 CLS:PCLEAR1:CLEAR 20000:DIM L$(1700)
    2 PRINT " MERGER "
    3 INPIUT " HOW MANY FILES TO BE MERGED ";NF
    4 FOR F=1 TO NF:PRINT " FILE£ "F":";:LINE INPUT FT
$(F):NEXT F
    5 LINE INPUT " NEW FILE NAME : ";NN$:LINE INPUT "R
EADY CASSETTTE";P$
    6 FOR D= 1 TO NF:OPEN "I",-1,FT$(D)
    7 LINE INPUT£-1,L$(X):PRINT L$(X):X=X+1
    8 IF NOT EOF (-1) THEN 7
    9 CLOSE:NEXT D
   10 LINE INPUT " NEW TAPE ";P$:LINE INPUT " PRSSRECO
RD";P$
   11 OPEN "O",-1,NN$:FOR D=0 TO X:PRINT£-1,L$(D):NEXT
 D:CLOSE
   12 PRINT "FILES";:FOR S=1 TO NF:PRINT FT$(S)",";:NE
XT S:PRINT CHR$(8)" MERGRD INTO "NN$
   13 END
```

Finally, CLoad this program and make any modifications you wish, and then save it without the A option to speed loading.

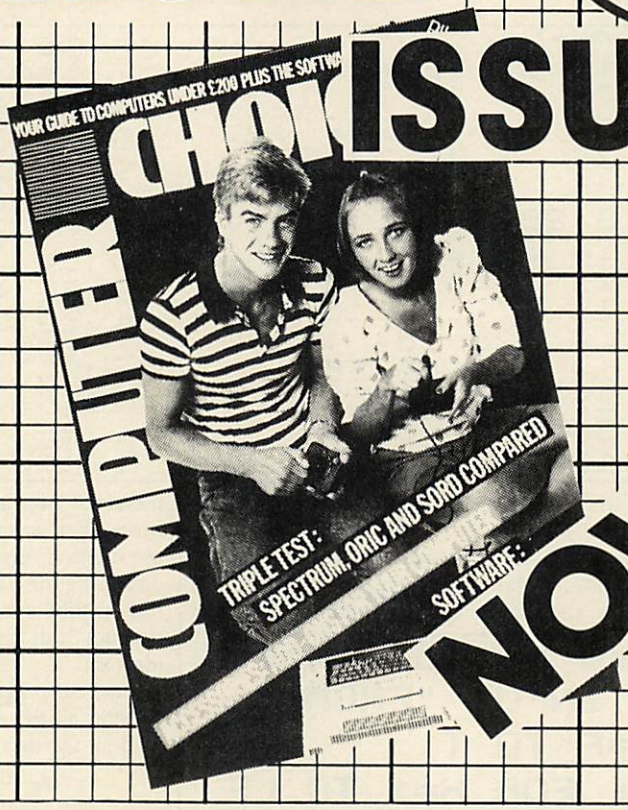
Merger should not introduce any errors into your program, with the exception that some programs, especially those which use many read and data statements, combined with others may behave differently. ■

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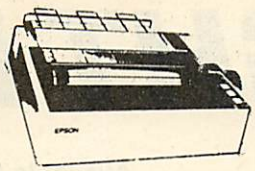
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COMPETITION CORNER

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in November. The name of the winner, the solution, and a competition report will be published in the January, 1984 issue of *Your Computer.*

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.

COMPETITION RESULTS AND WINNERS

INSPIRATION WAS thin on the ground among the entries for September's crossword competition. The prize. a Mattel Aquarius, was surely attractive enough but only a few entries met the exacting standard of wit and pithiness that *Your Computer* has come to expect from its competitors. "This is the dawning of the Age of Aquarius" seemed quite appropriate initially but less so after the 50th reading. Perhaps our opening sentence, "A Mattel Aquarius would be the start of a new age becuase . . .", was to blame.

Astrological references were rife. M Swan quipped "I am like a Pisces out of water without one"; and D Homer claimed that "Aries Taurus last one to Pisces".

Signs of the Zodiac

The ingenuity some people expended on dragging in as many signs of the zodiac as possible knew no bounds. J Soames thought that "as a Virgo to computing it has enough Aries for me" and "Its a Gemini Cancertainly to get RAM without going to Pisces" was C Cleverly's effort. S Pitchers topped these with "it Cancertain Leoperate in other Aries with extra bits and Pisces".

Other entries were more pithy as in J Lowe's "Mattel keeps you on your mettle", and G Lawson's "it whets the appetite without dampening enthusiasm".

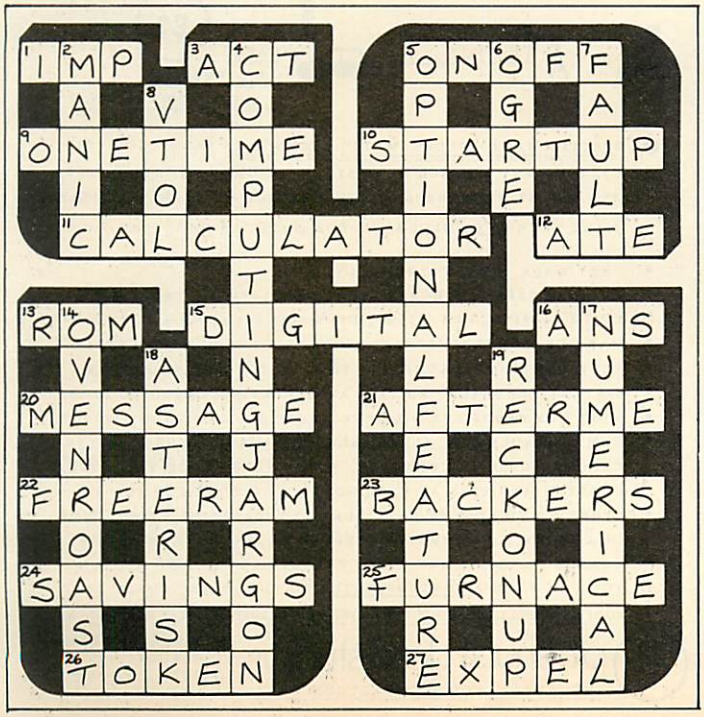
Some entries though were refreshingly different. R. Smith's "a double port sir, I don't mind if I do" and C Dumont's "it's heavy! Mattel mate" were two in particular. From L Gabb came "it's more than just a constellation prize" while D Marchant found a new variation on an old favourite in "it boldly glows where none has shone before".

The Honeycomb problem

We hovered over these but finally plumped for the entry from R Godfrey Westfield, Portsmouth Road, Milford, Godalming, Surrey, who burst into alliteration with "Acquiring Aquarius abolishes antiquarian abacus adds acumen, audio and aquatints aquamarine amusements".

The only easy way to solve the Honeycomb problem was to key in the program and try it out. In fact the program runs anti-clockwise and all the corner cells print our successively closer approximations to the cube root of x.

Surprisingly, it makes no difference where you join the loop after the central start point. Only Max Richardson, 14 Lambscroft Way, Chalfont St Peter, Buckinghamshire, pointed this out and he wins the £15 book token.

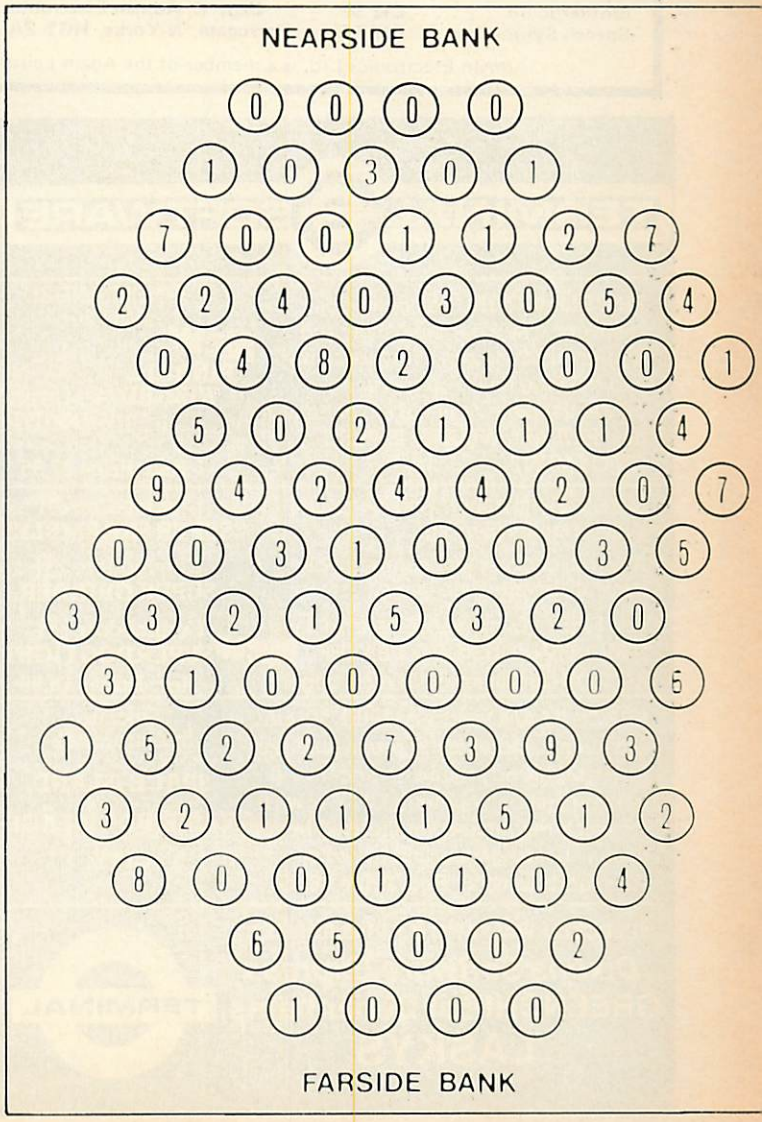


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BY ANTHONY ROBERTS

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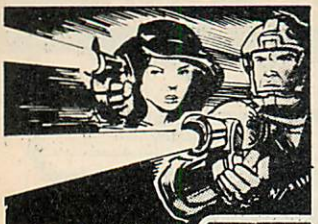
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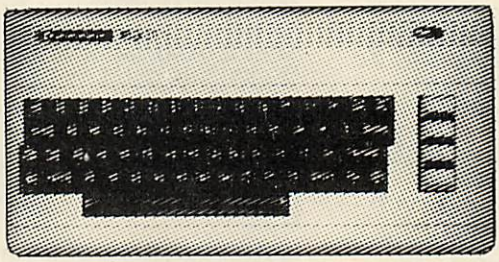
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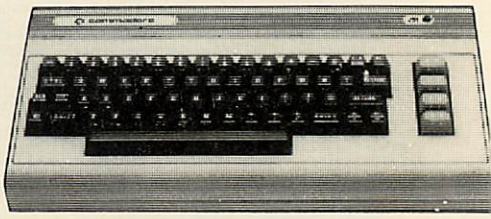
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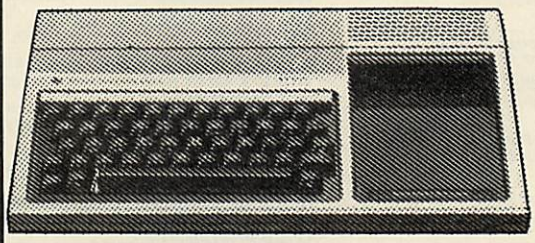
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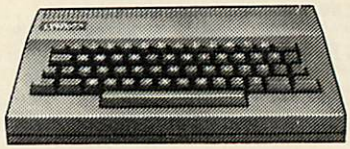
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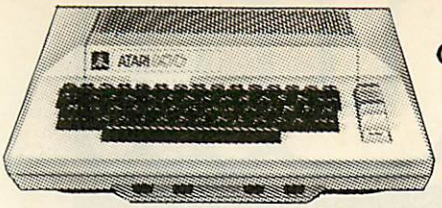
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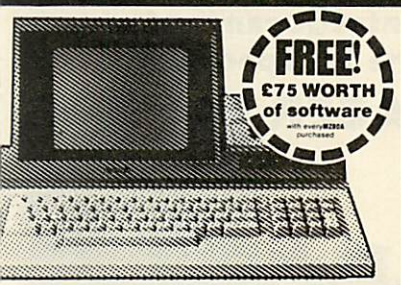


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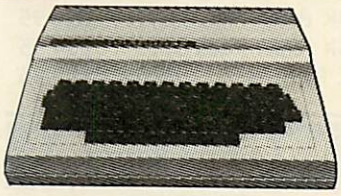
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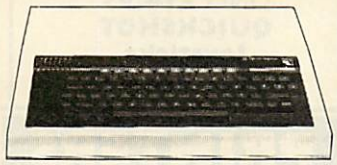


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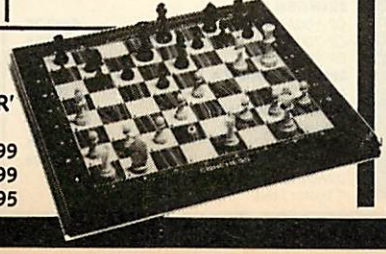
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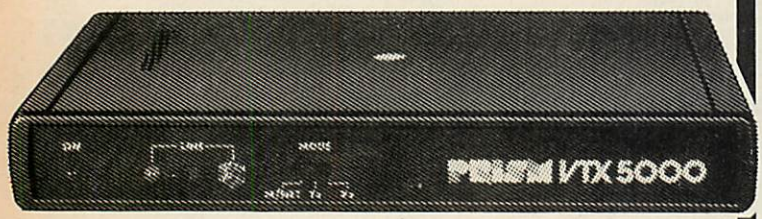
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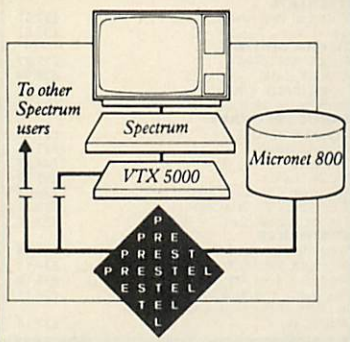
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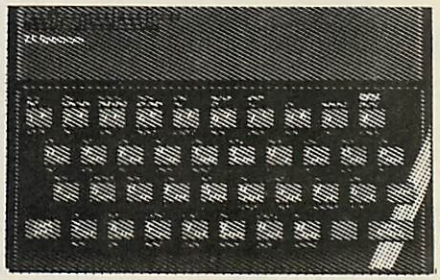
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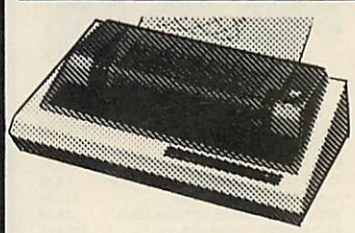
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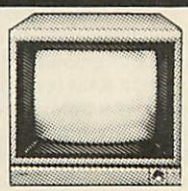
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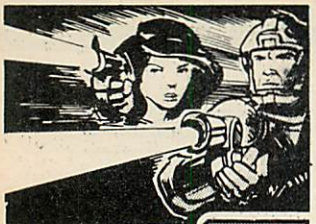
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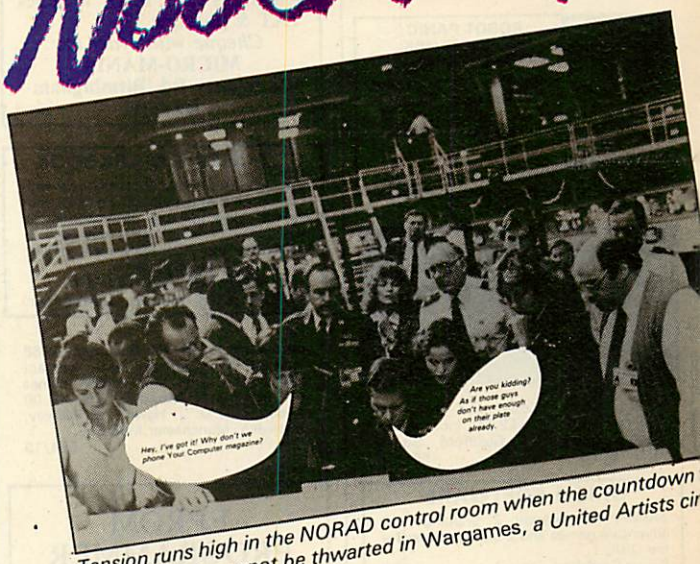
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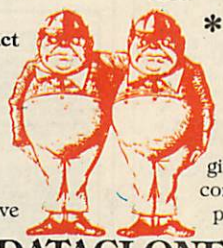
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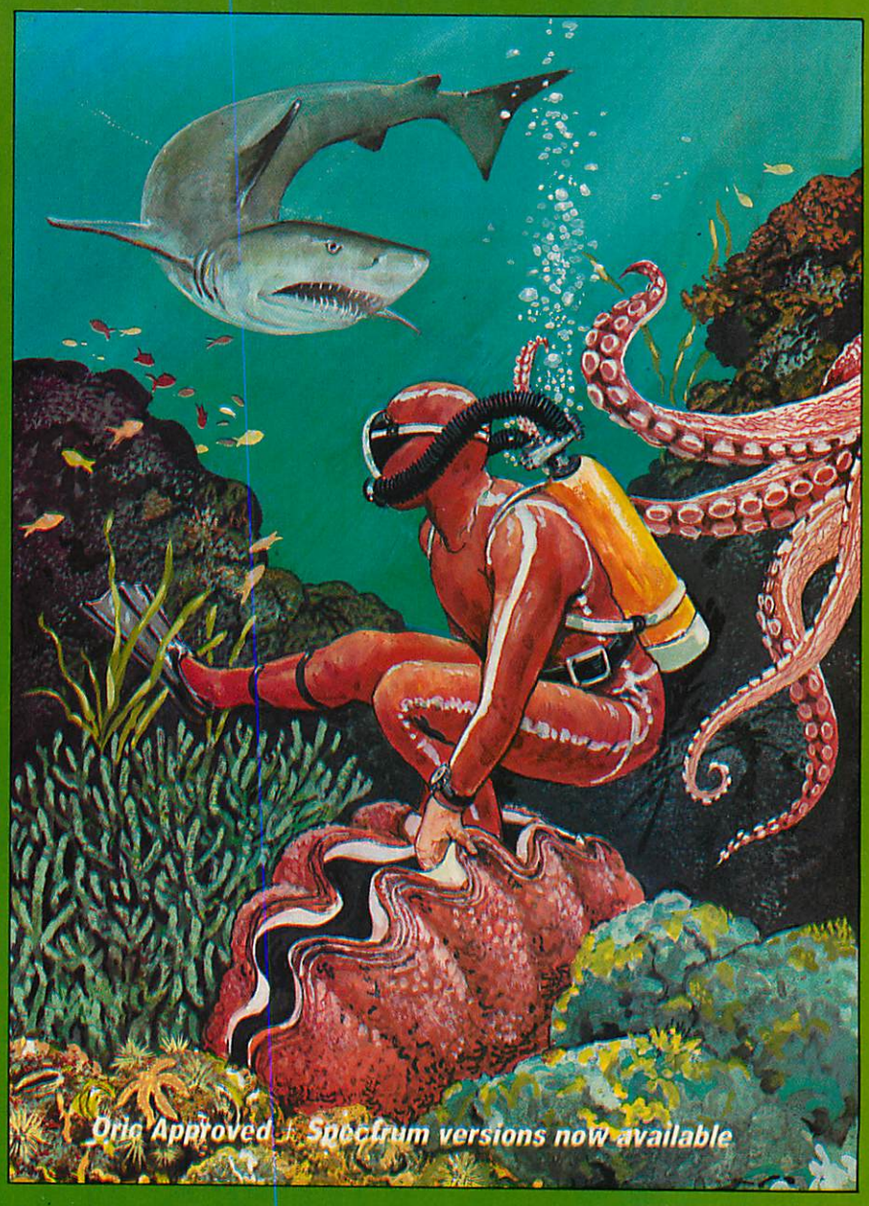
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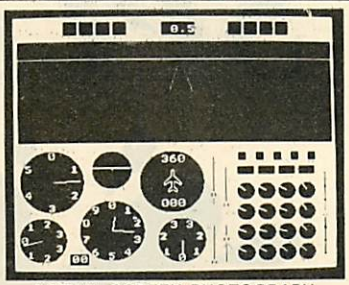
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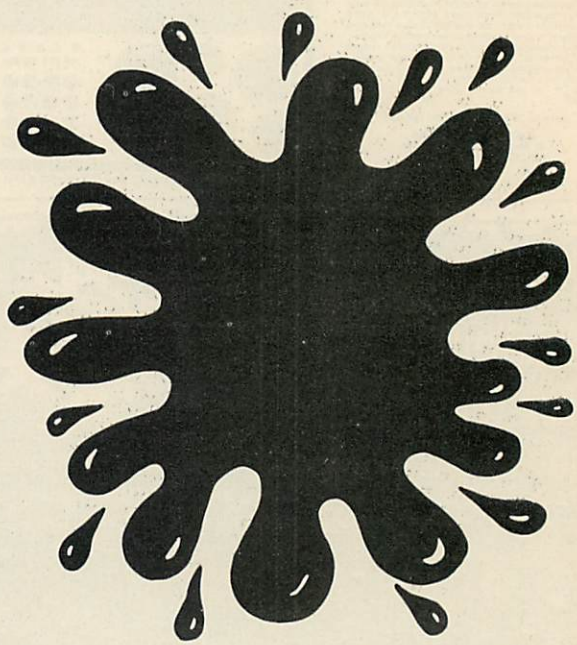
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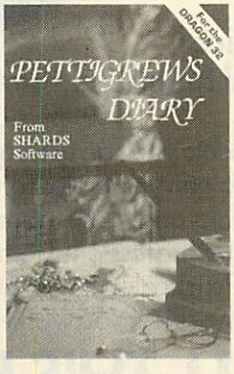
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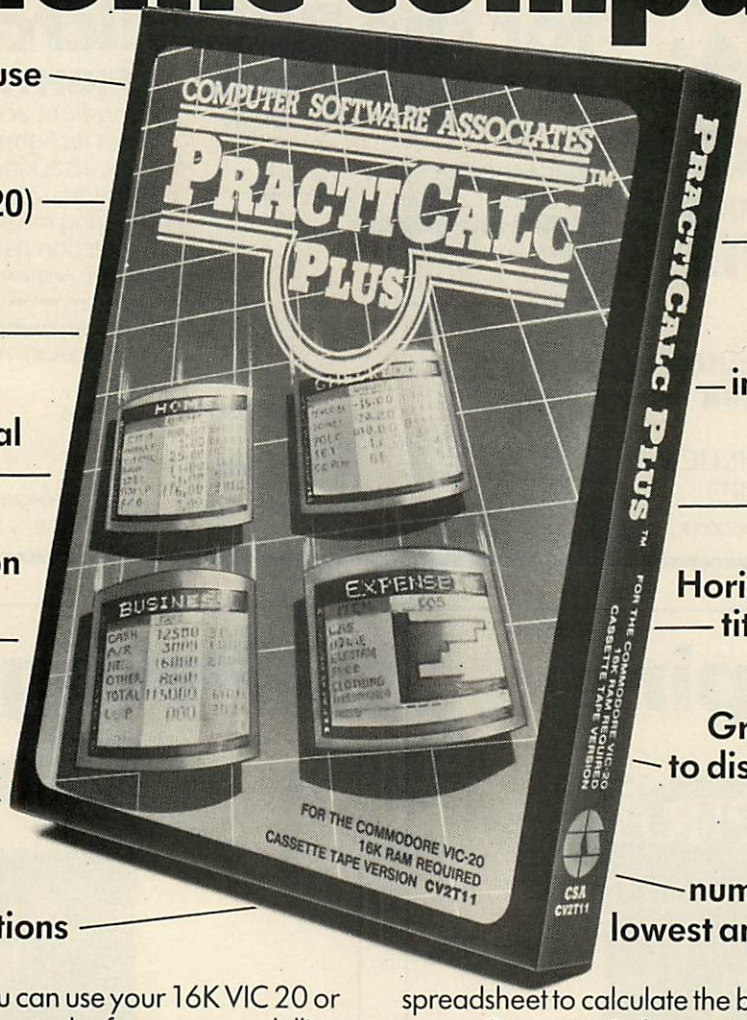
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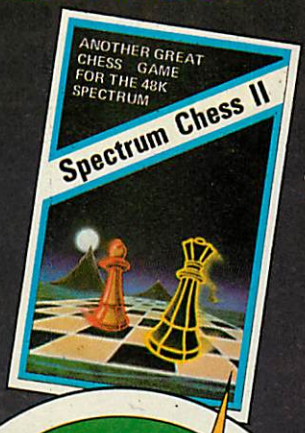
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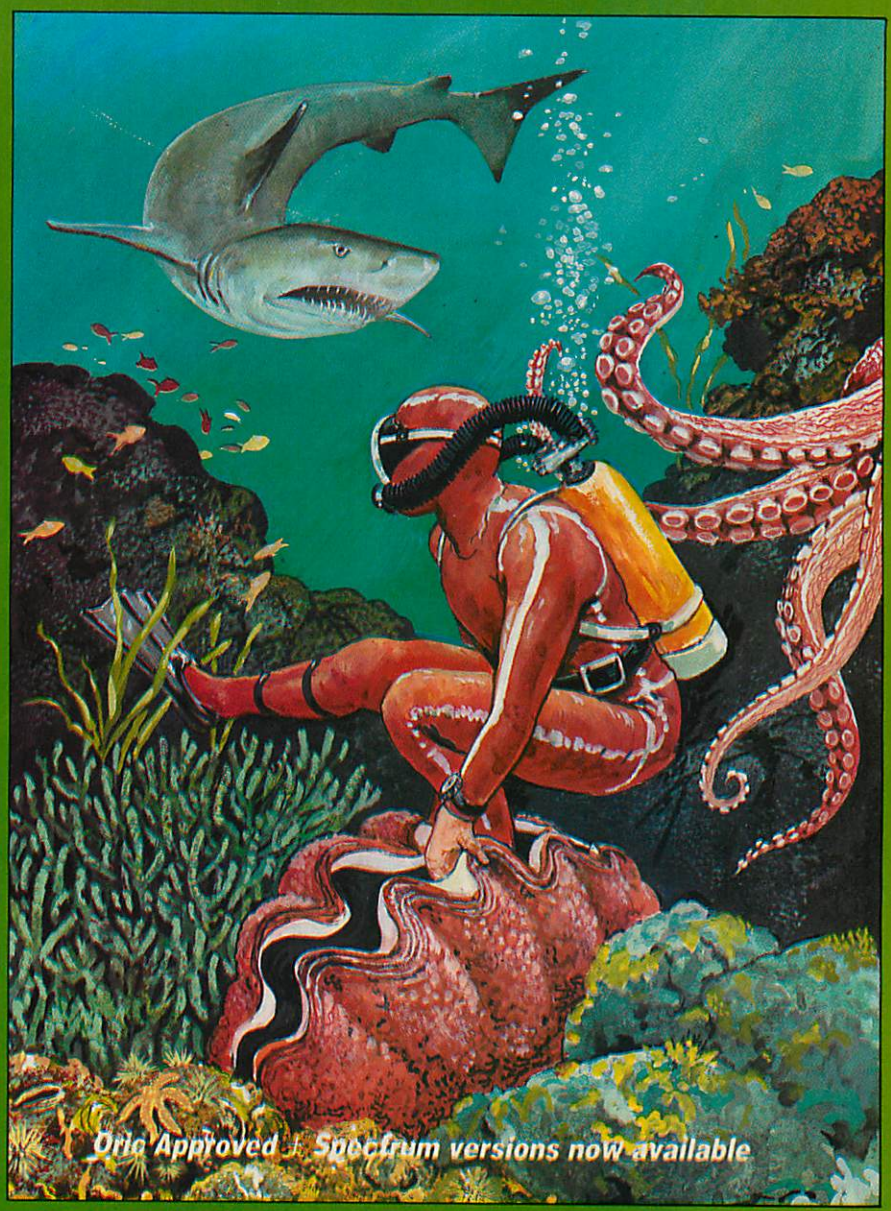
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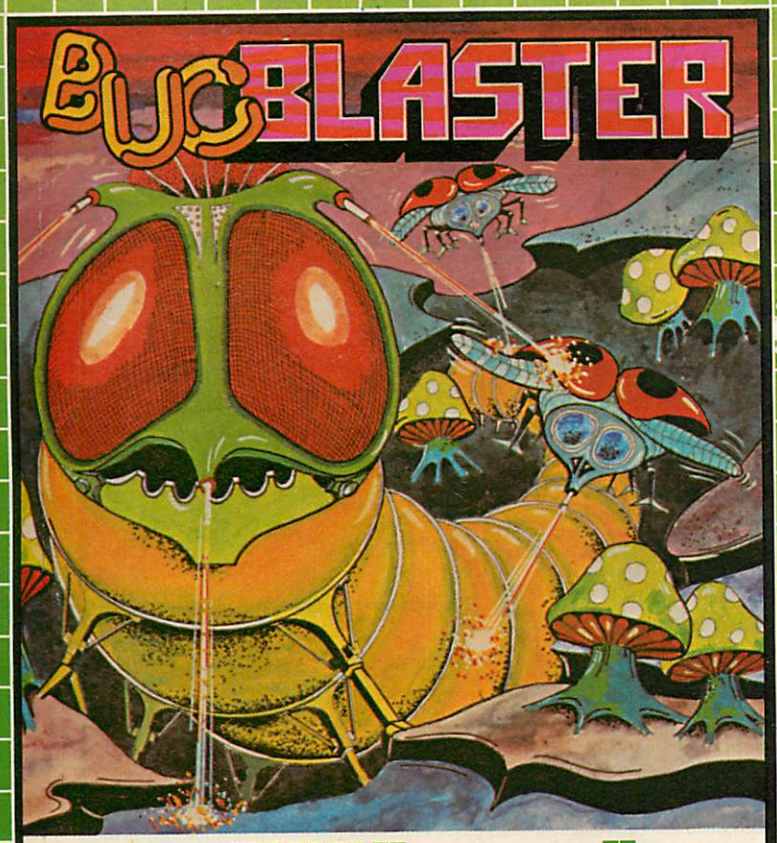
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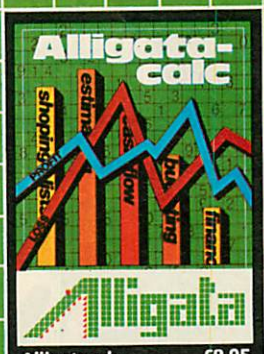
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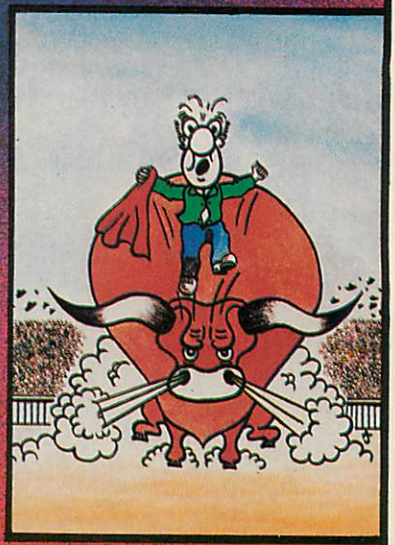
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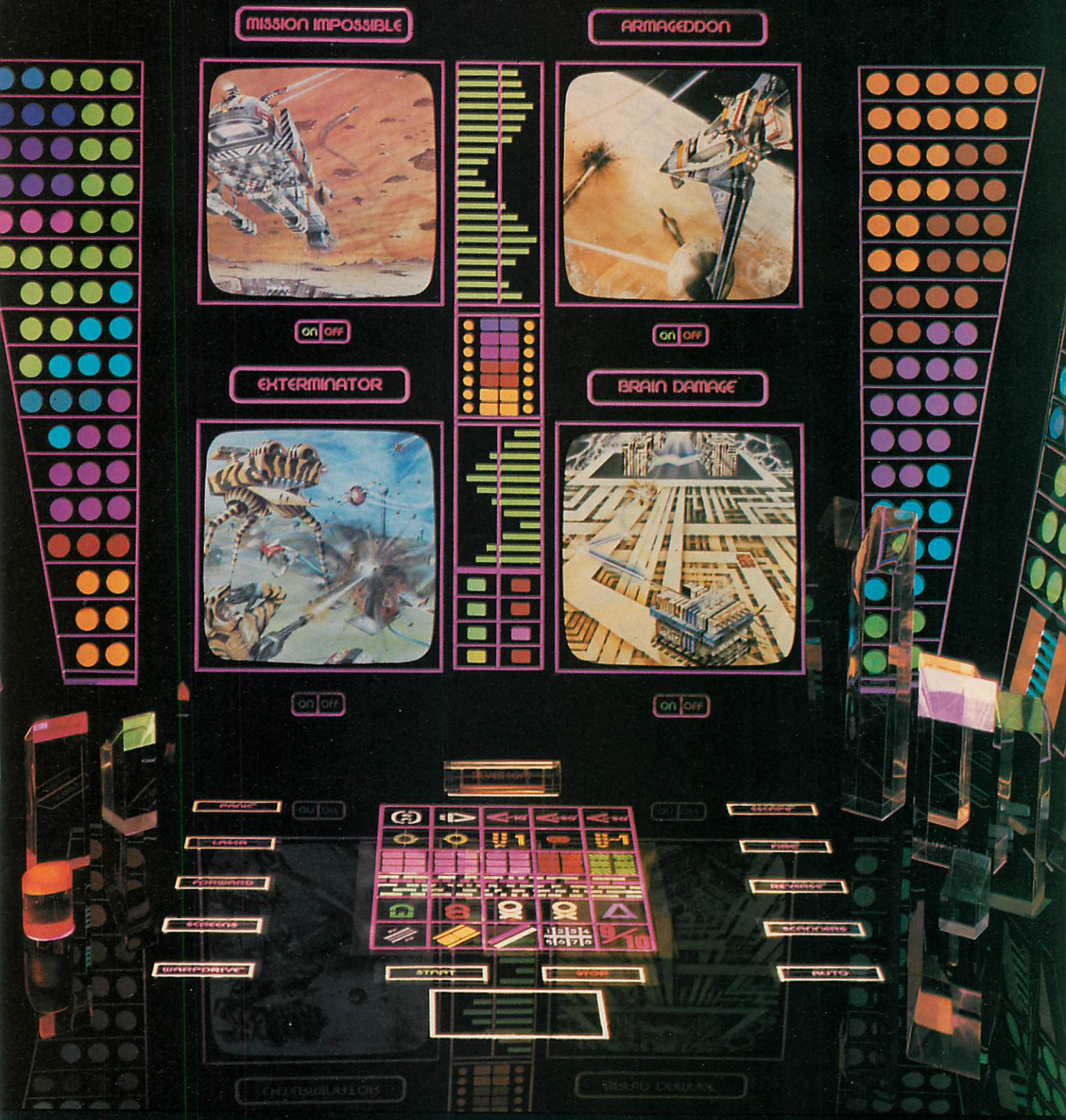




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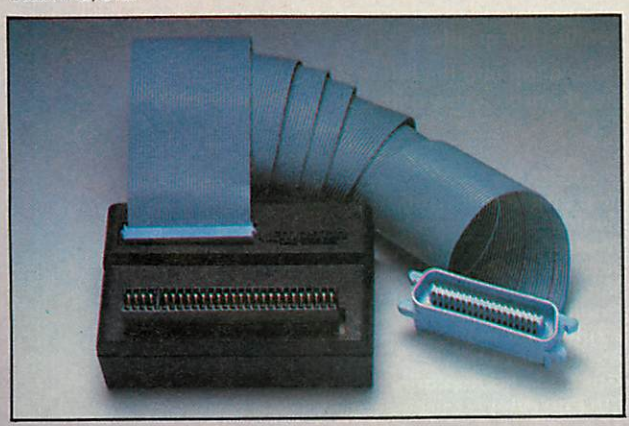
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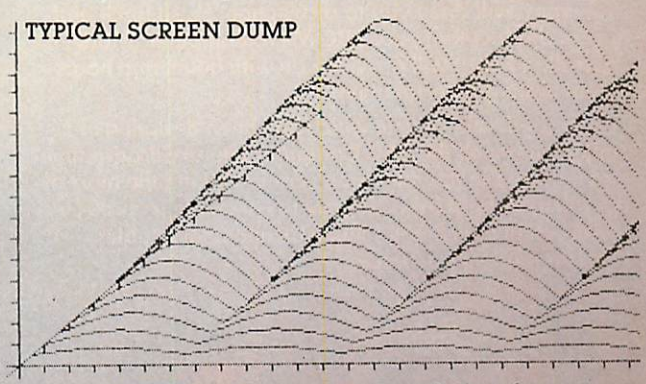
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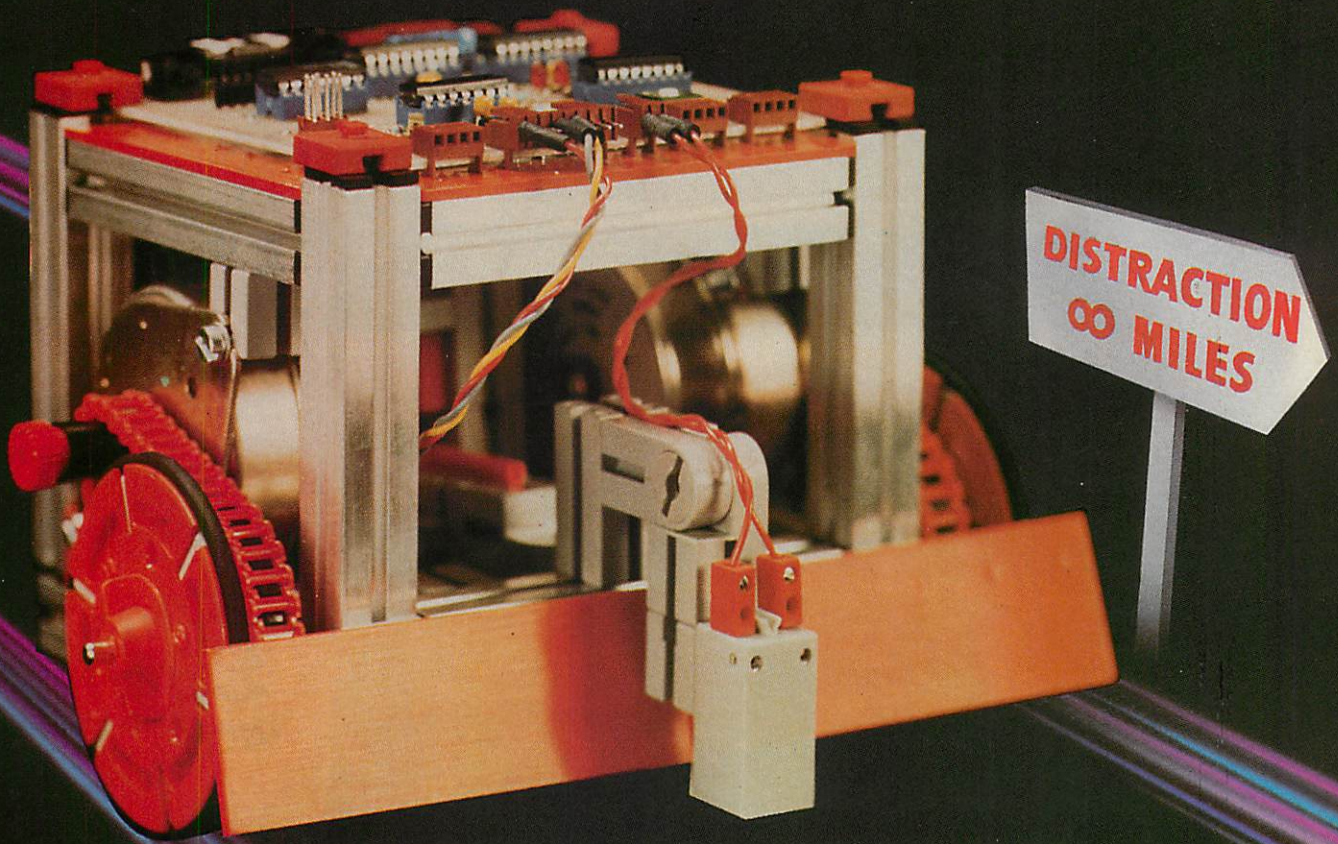
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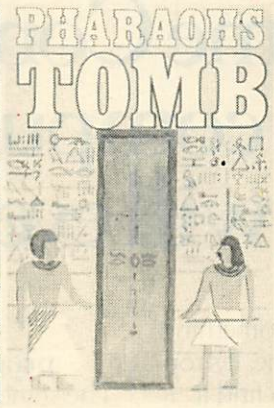
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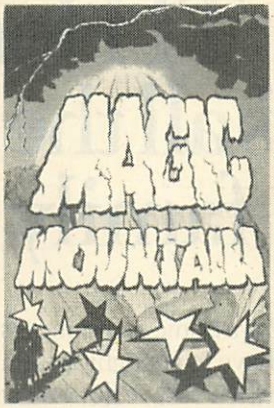
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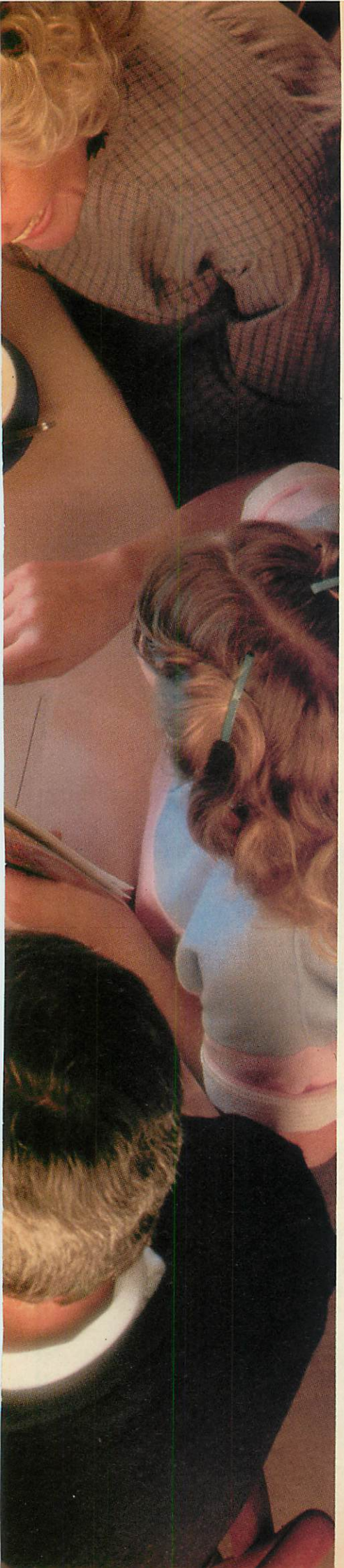
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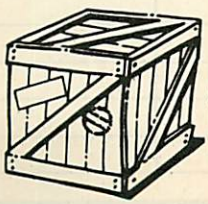
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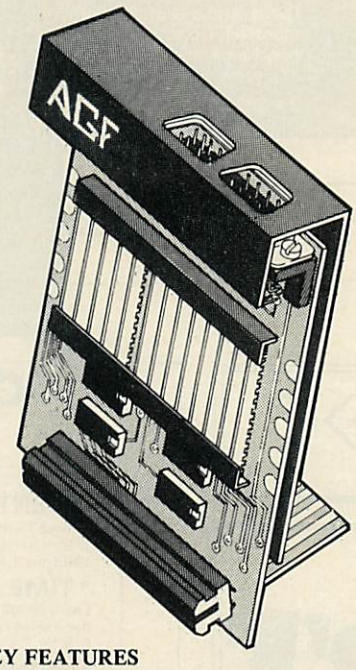
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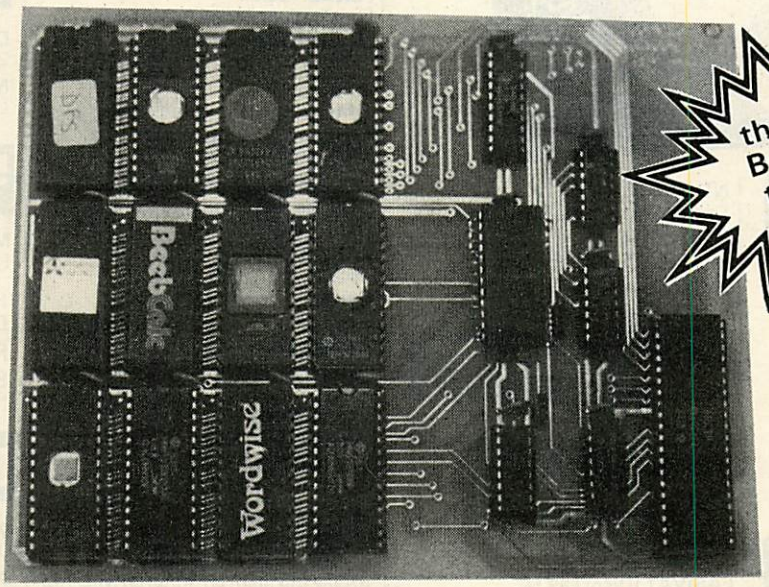
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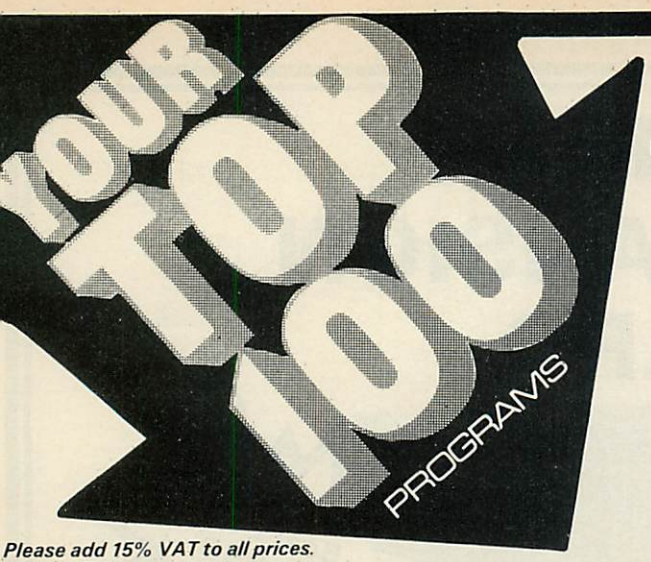
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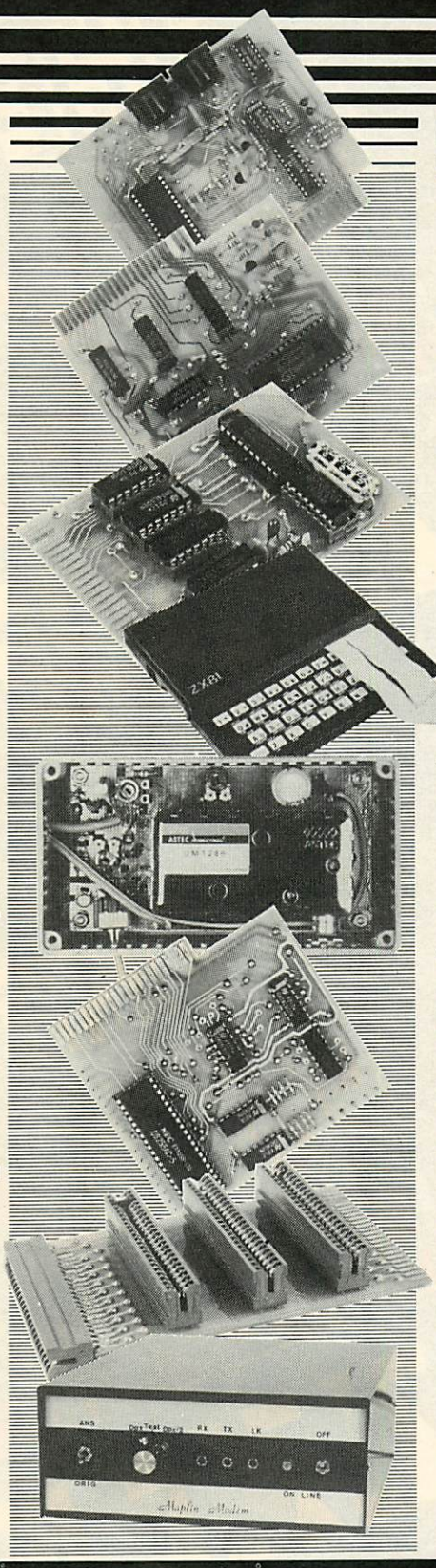
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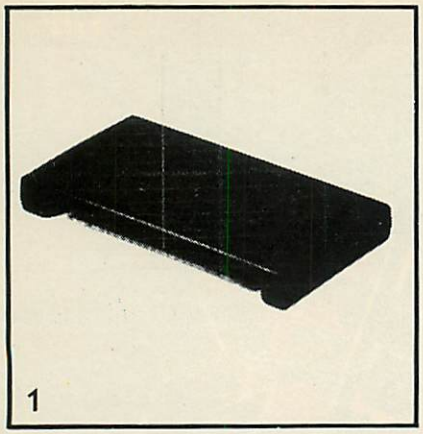
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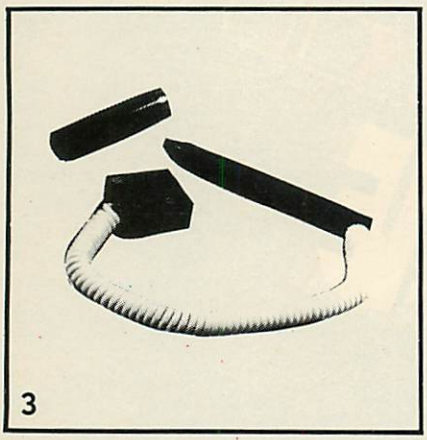
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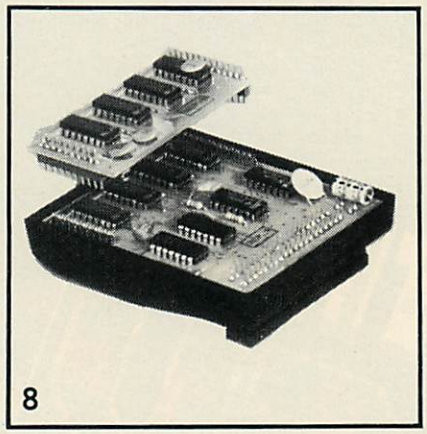

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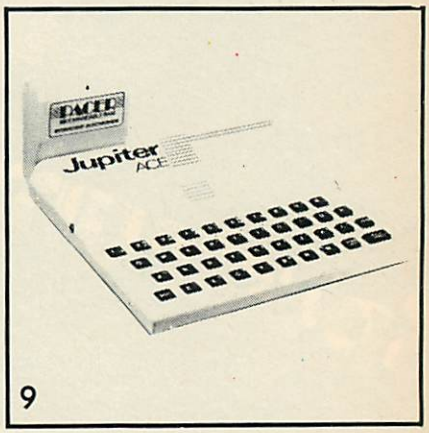

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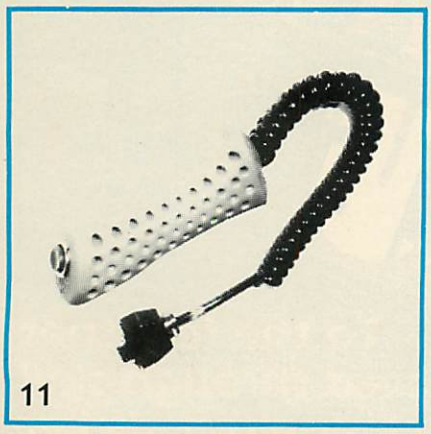


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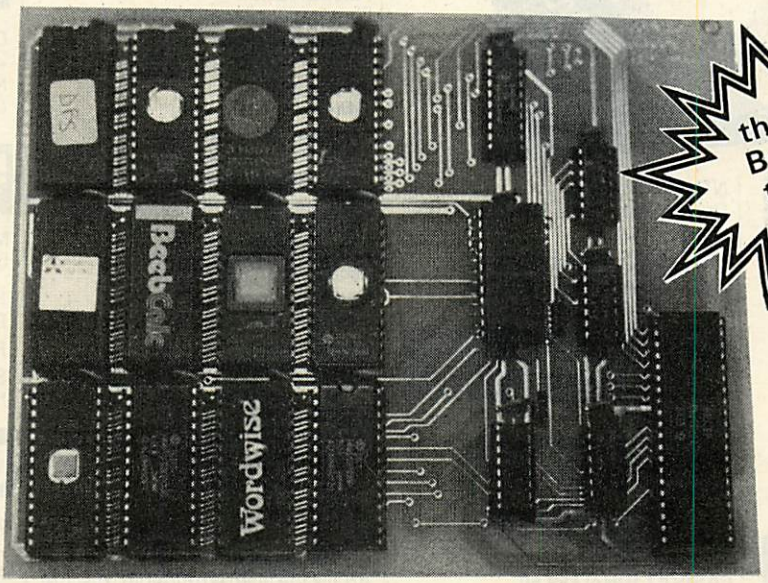
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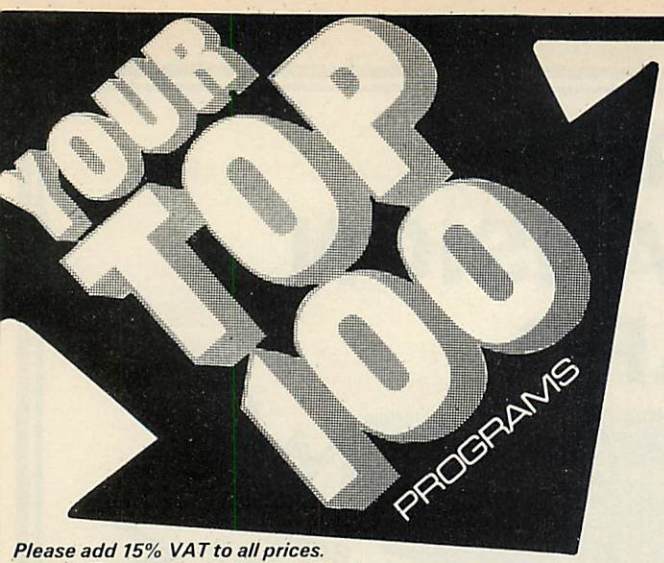
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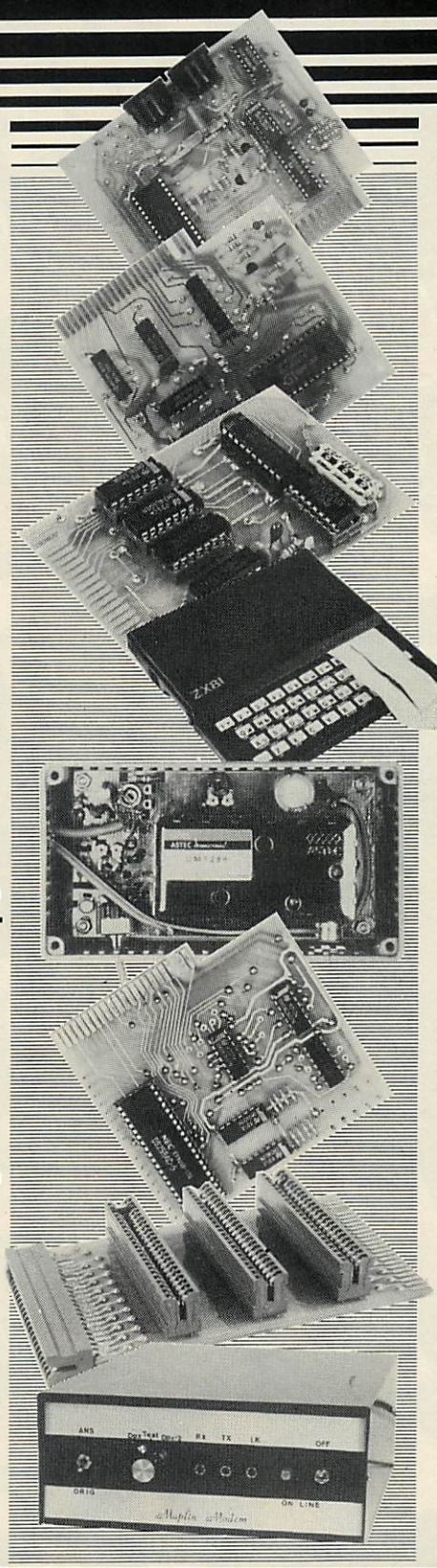
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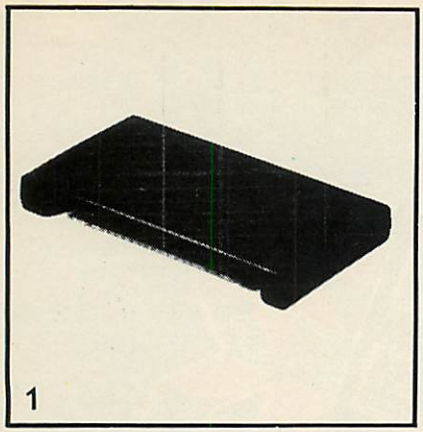
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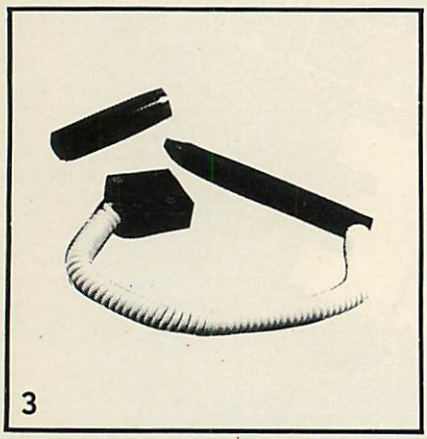


1

8. 16K Expansion Module £14.50 The Expansion Module allows an increase in memory of the basic ZX-Panda or Pacer by a further 16K. It is unique in that the expansion module fits internally in the original RAM Pack. The Expansion is achieved by simply plugging the module into the connectors provided on the original RAM board. Ease of connection allows the user to plug in the module without requiring electronic knowledge and full fitting instructions are provided with each module. **NOTE:** The expansion module fits no other ZX-81 RAM Pack other than the ZX-Panda.

9. Pacer 16K Expandable Ram £19.95 A unique 16K RAM for the Jupiter Ace, giving a full 16384 bytes of extra Random Access Memory. The PACER is unique in that further expansion to 32K is obtained by plugging in a 16K expansion module internally in the original 16K case. The custom made case is contoured to the back of the Jupiter Ace for maximum suitability and in conjunction with the positive fitting connector, ensures that the RAM pack is completely wobble free. The PACER plugs directly into your Jupiter Ace expansion port and needs no additional power supply. The PACER is neat and compact housed in a high quality ABS injection moulded case, the PACER is not just an add on, but a complementary unit to the Jupiter Ace, complete with an L.E.D. to indicate computer power "ON".

10. White Echo £19.95 White Echo not only enables the Jupiter Ace sound output to be brought into audible range, but eases the tedium of saving or loading of tapes and enlarges the range of tape recorder compatibility with the computer by means of internal filters. The amplifier has volume control over a range adequate for most uses, and a tone control for harsh or mellow sounds. A switched interface removes the need to swap leads during 'SAVE'ing or 'LOAD'ing. Leads are left connected all the time and the desired function is selected on the three position switch by the user. Use of the 'CUE' facility enables an audio cue to precede the program being 'SAVE'd on tape, a decided advantage when searching through a multi-program tape. The Echo simply plugs into the Ear, Mic and Power sockets of the computer and does not require an additional power supply. The expansion port at the rear of the computer is left free for use with other peripherals and the unit is housed in an attractive case custom designed to complement the Jupiter Ace. White Echo has all the features of the ZX-Spectrum Echo, but is adapted for use with supiter Ace. Supplied complete with free 'Frogger' type game.



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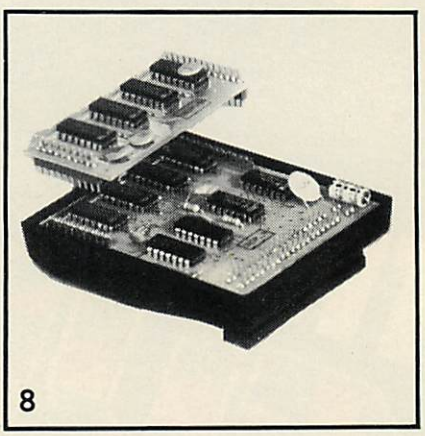


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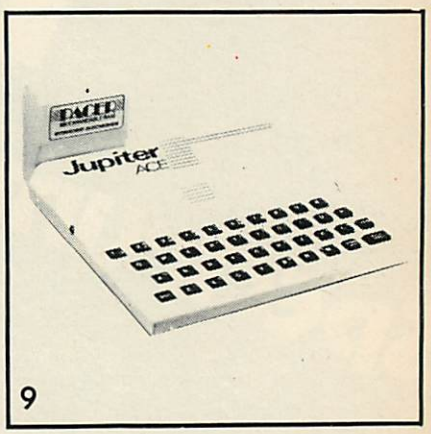
11. Stonechip Joystick £20.00 The Joystick senses the movement of the hand and therefore does not have to be fixed to a surface, giving greater freedom of movement and a new level of skill when used in games control. The joystick can be plugged straight into computers with Atari compatible games ports or into the ZX Spectrum via our Programmable Interface. Firm grip, flexible curly cable, and rugged construction, give the joystick the quality and reliability expected from Stonechip. Use the Stonechip joystick to bring a new dimension to the enjoyment of your computer.



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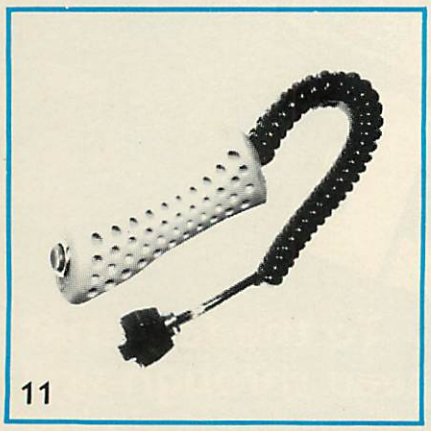
Programmers Aid for VIC 20 18 New commands for your VIC-20 including renumber, auto-line, sound, cursor XY, trace, block delete, paper, border, edit and more, all in fast machine code. A superb addition to your VIC-20 vocabulary, and an extremely useful programming tool. In ROM form, the Programmers Aid fits the 4K ROM socket on the Vixen Switchable Motherboard. In cartridge form, it fits directly into motherboards or the computer itself. In ROM form £14.95 and in cartridge form £22.45.

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STONECHIP ELECTRONICS

Let Stonechip Give Your Computer POWer!

About Ourselves Stonechip Electronics is a fast moving, highly tuned Design, Prototyping and Manufacturing House, providing a first class service in the field of micro-processing. We produce 'add-on' components and complementary units for popular home computers. We also create tailor made computer aids and custom designed micro processor systems and software to suit individual requirements.

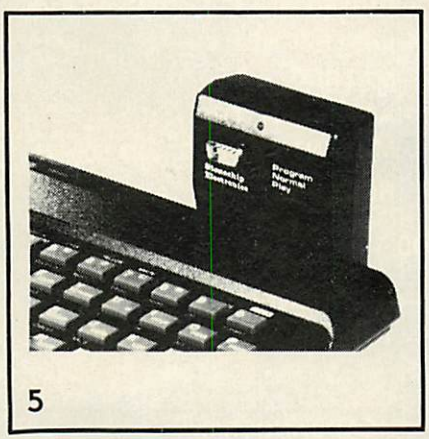
1. Vixen 16K Switchable Ram £34.95 The Vixen 16K Switchable Ram has all the versatility of the complete range of standard RAM cartridges. The switchability allows the unit to be used as 16K, locating in memory blocks 1 and 2, 8K which can be located in memory blocks 1 or 3 (for use by itself or in addition to a 16K cartridge), 3K to fill the 3K gap in the memory map, or 11K (8K and 3K together with the 8K in memory block 3). Two Vixen 16K cartridges switched in opposition will give full memory expansion available by direct addressing, and because it is universal, the Vixen can be configured to run any available Basic program without readdressing. Contacts are gold plated and the unit is housed in an attractive high quality ABS injection moulded case, with the switches recessed to avoid accidental operation. The switches are also positioned such that they cannot be changed while the unit is inserted in the computer.

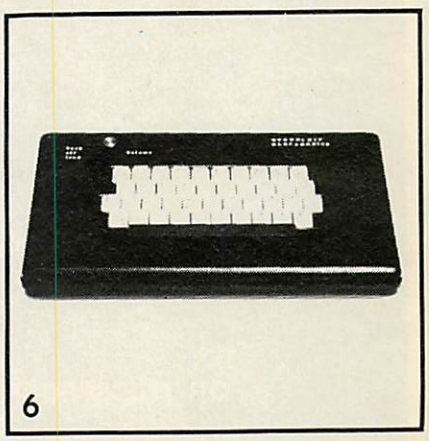
2. Vixen Switchable Motherboard £31.95 The Vixen Switchable Motherboard is un-powered, relying on the computers own power supply to enable up to 4 cartridges to be used at the same time. Three of the cartridge slots are on the top of the unit and the fourth is located horizontally at the back to allow further expansion of the system. The two rear positions can be switched in or out, or can be relocated in memory by switching, and the 4K ROM socket is available for ROM based firmware, such as toolkits, etc. Housed in an attractive custom made case, the Switchable Motherboard is extremely versatile and a very desirable addition to the VIC-20.


2

3. Stonechip Light Pen £19.95 The Light Pen allows the user to draw and paint in colour on screen. It is ideal for screen layouts, graphic design or as a games aid. Screen layouts created can be altered and erased as desired and the finished work can be saved on tape for future use. Horizontal and vertical resolution is second to none and with superb stability. The pen works perfectly in the High Resolution Graphics Mode, even though the resolution determined by the VIC-20 is only ¼ pixel.

4. Echo Amplifier £19.95 Echo not only enables the ZX-Spectrum sound output to be brought into audible range, but eases the tedium of saving or loading of tapes and enlarges the range of tape recorder compatibility with the computer by means of internal filters. The amplifier has volume control over a range adequate for most uses, and a tone control for harsh or mellow sounds. A switched interface removes the need to swap leads during 'SAVE'ing or 'LOAD'ing. Leads are left connected all the time and the desired function is selected on the three position switch by the user. Use of the 'CUE' facility enables an audio cue to precede the program being 'SAVE'd on tape, a decided advantage when searching through a multi-program tape. The Echo simply plugs into the Ear, Mic and Power sockets of the computer and does not require an additional power supply. The expansion port at the rear of the computer is left free for use with other peripherals and the unit is housed in an attractive case custom designed to complement the ZX-Spectrum.

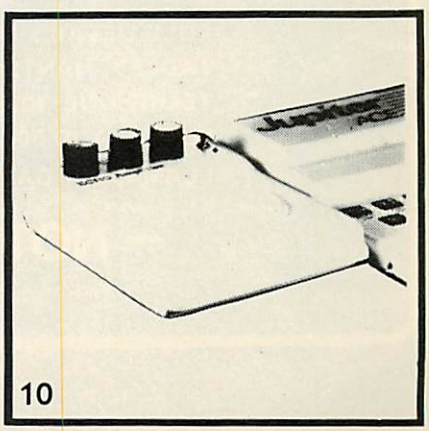

5


6

5. Stonechip Programmable Joystick Interface £24.95 Allows use of any game with joysticks. Joystick directions and functions can be programmed easily to simulate any keyboard function. Programming is easy, only uses a switch. Switch one way to program and another way to play. Centre position of switch allows normal operation of ZX-Spectrum. No tapes to load or links to worry about - all programming is achieved by hardware. Used with Atari -compatible joysticks. Simply plugs into rear expansion port of ZX-Spectrum. No other connections to make, no additional power supply required.

6. The Stonechip Spectrum Keyboard £55.00 This ZX-Spectrum keyboard is a high quality unit, featuring a standard typewriter keyboard layout using high quality key-switches in a QWERTY format; a full size space bar, a single entry double shift key, a double entry RESET function, and an integral amplifier. The Stonechip Keyboard is designed to house your computer within the case and the keyboard plugs directly into the rear port. It will not interfere with any add-ons, and does not require you to open your Spectrum - hence it will not invalidate your guarantee. The keyboard is housed in an attractive black plastic case, with an internal amplifier which not only amplifies the sound from your Spectrum but will also aid 'LOAD'ing programs.

7. ZX-Panda 16K Expandable Ram £24.95 A uniquely expandable 16K RAM for the ZX-81, giving a full 16384 bytes of extra Random Access Memory. The ZX-Panda is unique in that further expansion to 32K is obtained by plugging in a 16K expansion module internally in the original 16K case. The custom made case is contoured to the back of the ZX-81 for maximum stability, and in conjunction with the positive fitting connector, ensures that the RAM pack is completely wobble free. Independent testing shows the RAM Pack faultlessly operational under extreme testing. The ZX-Panda plugs directly into your ZX-81 expansion port and needs no additional power supply. The ZX-Panda is neat and compact. Housed in a high quality ABS injection moulded case, the ZX-Panda is not just an addition, but a complementary unit to the ZX-81, complete with an L.E.D. to indicate computer power 'ON'.


10


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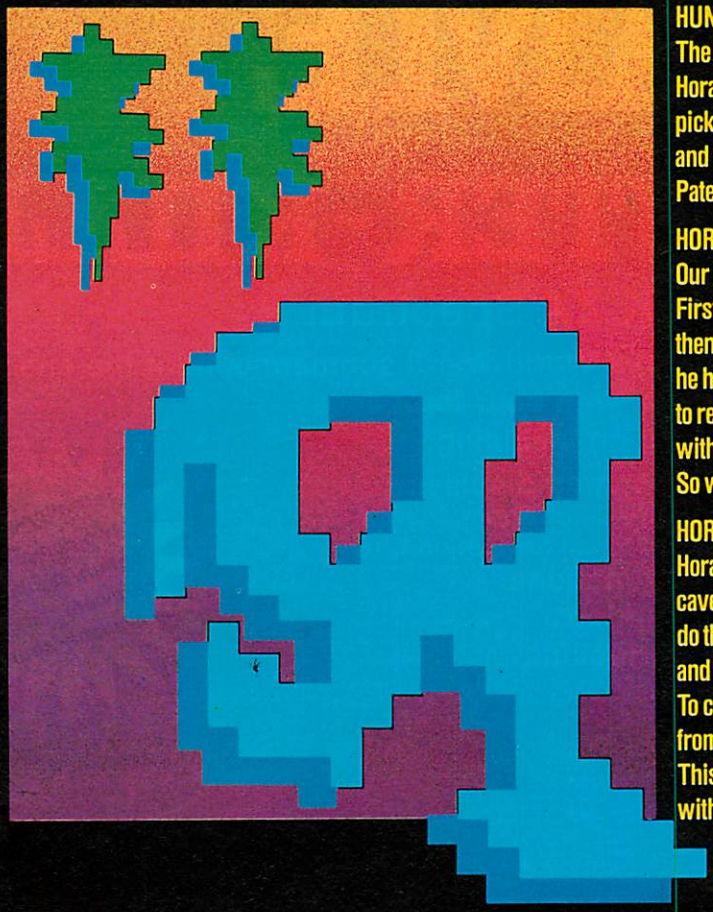
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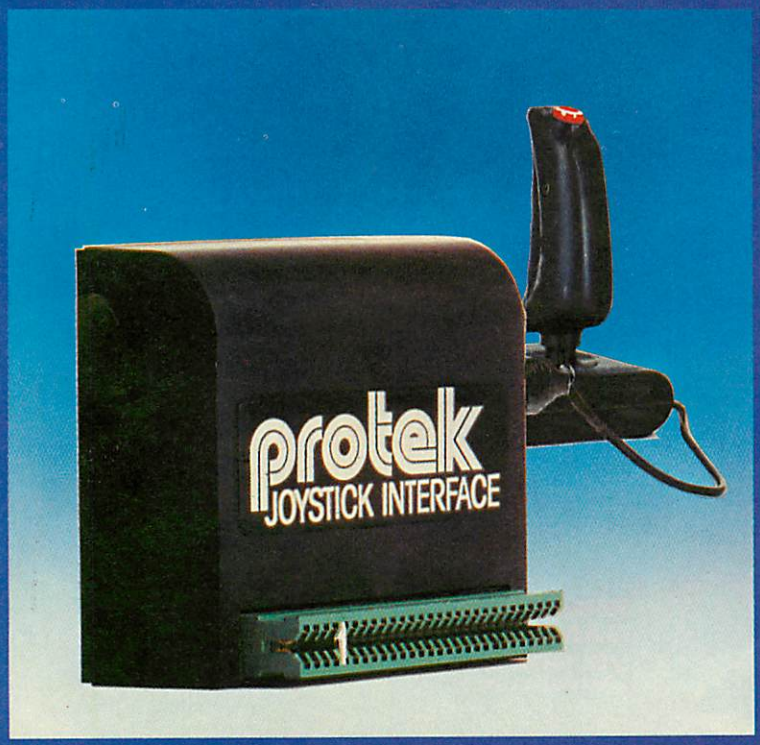
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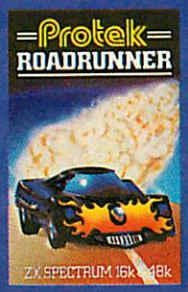
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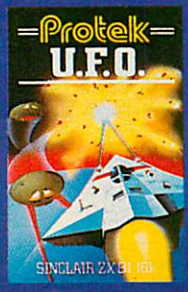
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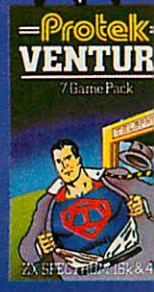












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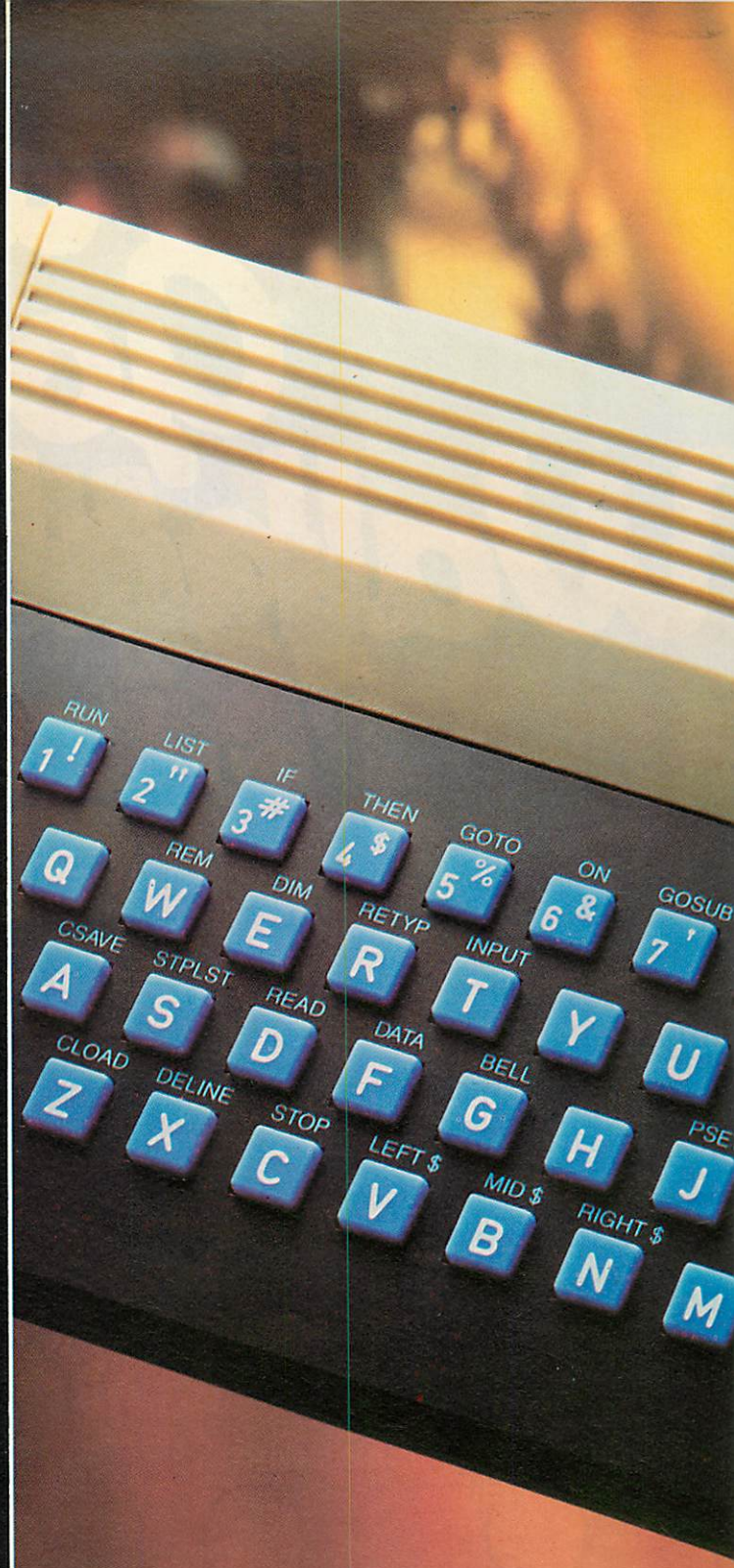
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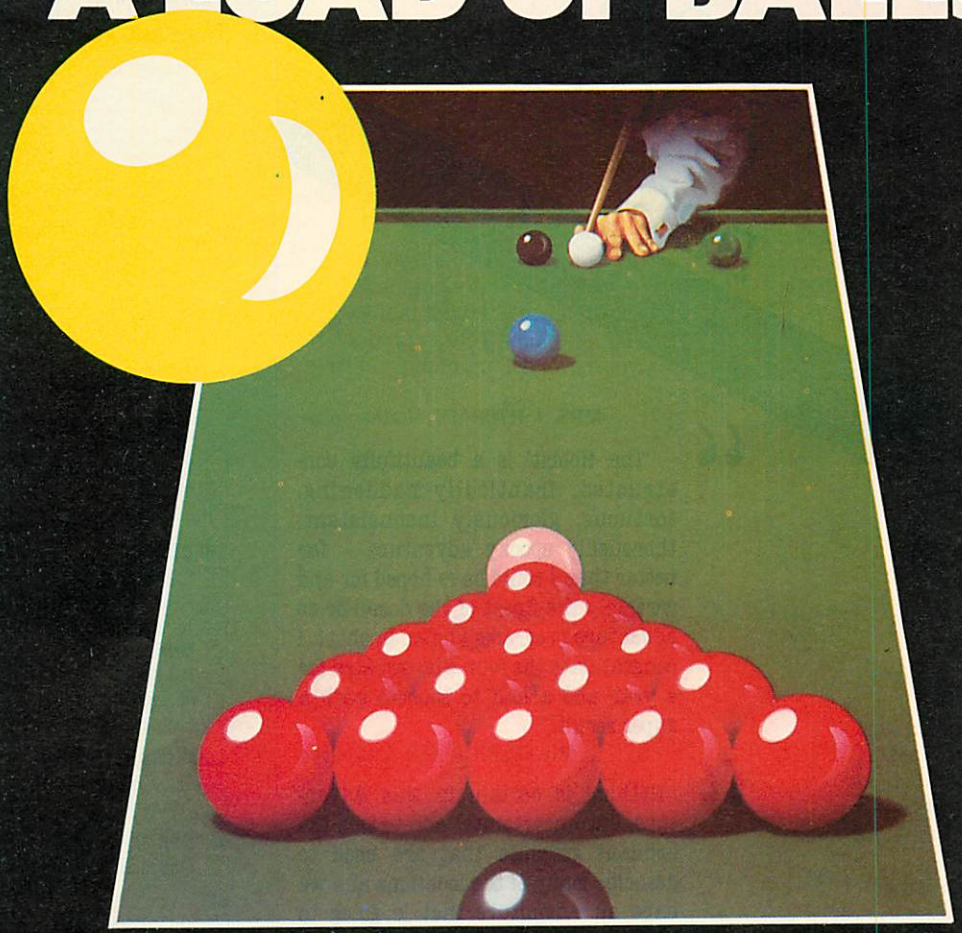
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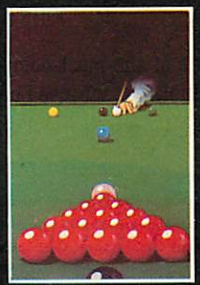
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"I am the owner of a copy of 'The Hobbit' which is wonderful entertainment, and ver challenging. I have other tapes and publications of yours, all of which are excellent."

MR. D.J. BURGH, Ke

"Having received the most excellent piece programming I have ever seen, we have ha no social life whatsoever. 'The Hobbit' has been dominating our lives since January an many nights have been spent until 3 o'cloc trying to conquer it."

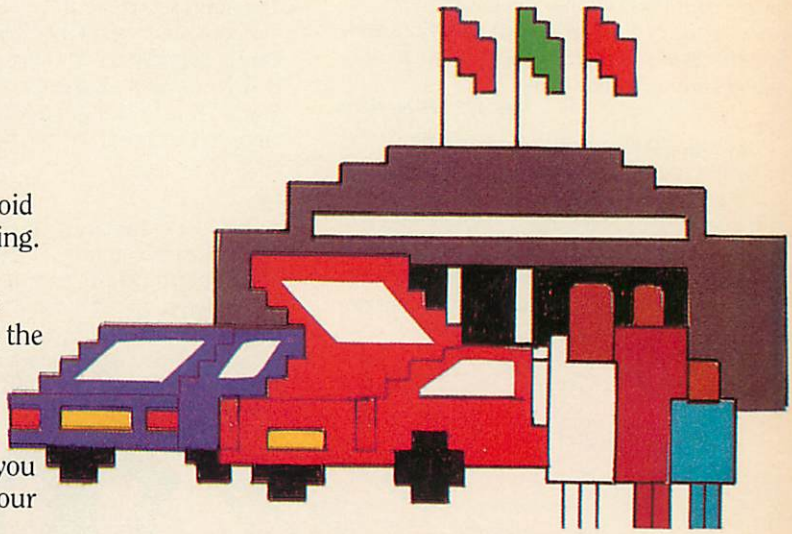
SIMON ROGERS, Av

"I have recently purchased your excellent adventure game 'The Hobbit'. This g greatly enhanced by the use of graphics, its availability in t originality of having t ly to e



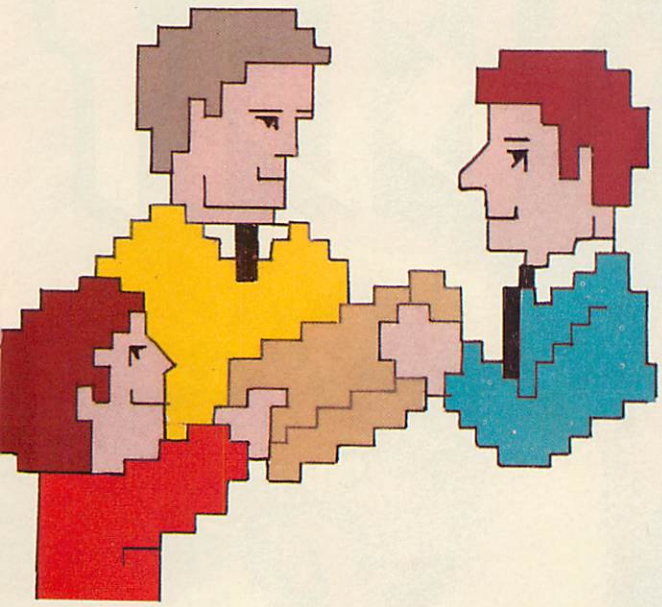
Melbourne Hous

For Choice...



Why not be spoilt for choice this Christmas and avoid all the usual rush, hassle and frustration of present buying. By visiting the first Your Computer Christmas Fair (December 15-18) you can be sure of seeing a truly vast range of microcomputer products, all under one roof at the Wembley Conference Centre, the most modern and comfortable exhibition venue in the country.

Whether you're interested in choosing a micro for home management, child education or games playing, you can see everything demonstrated at the show, with all your questions answered by expert sales staff from the manufacturers, dealers and software houses. Huge amounts of software and hardware, add-ons like joysticks and printers, plus a special Sinclair Village, will be at the show, so you can purchase the system you really want.



Large product stocks held on site mean no one will be disappointed and, because most exhibitors will accept major credit cards, you can try and buy in comfort, at the show.

As Wembley Conference Centre has parking for a staggering 5,000 cars you will be able to take away all the purchases you make on the day. The Conference Centre, with its excellent and economical catering facilities, is the ideal pre Christmas treat for the whole family, away from the high street crush.

Opening times are from 10 am to 6 pm every day except Friday – Special late night 8 pm closing. Because the exhibition remains open until 6 pm on the last Sunday before Christmas you can be assured of buying all your micro goodies.

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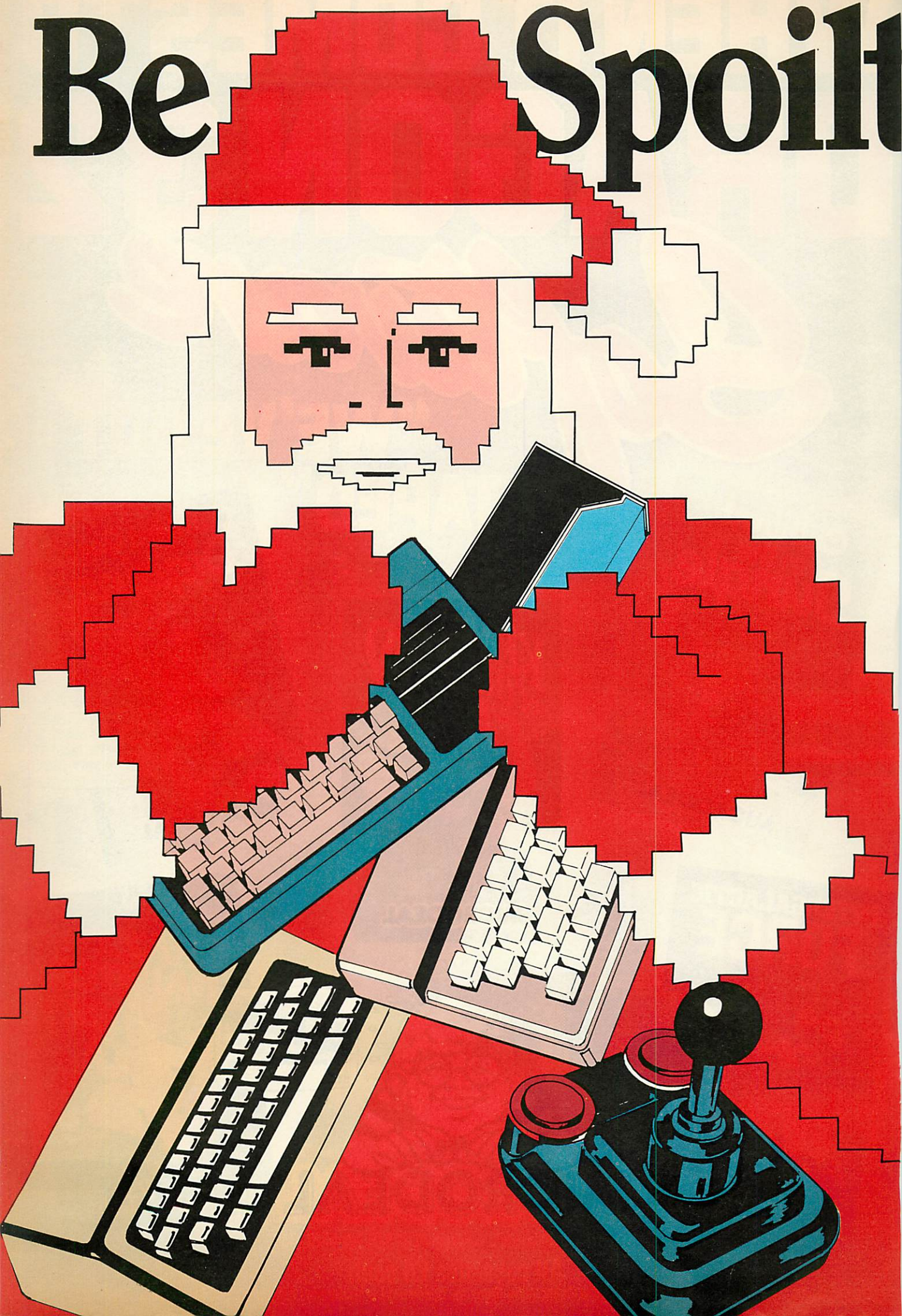
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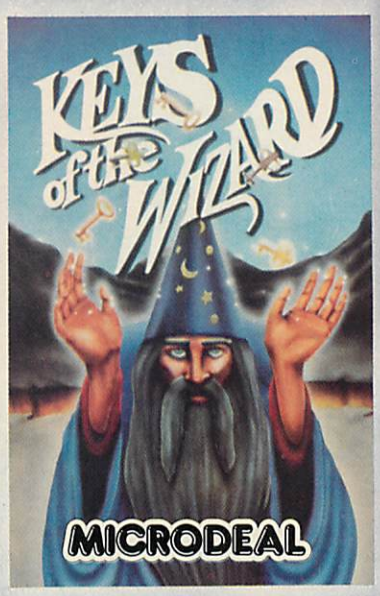
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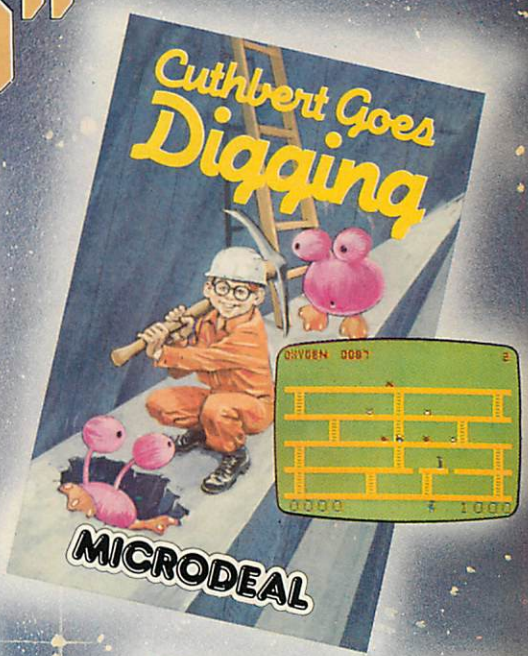


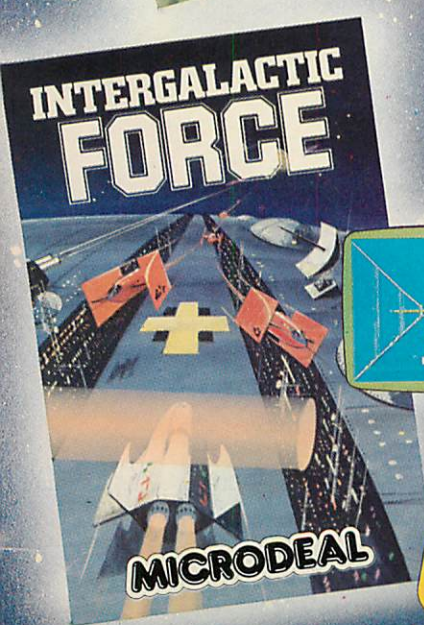
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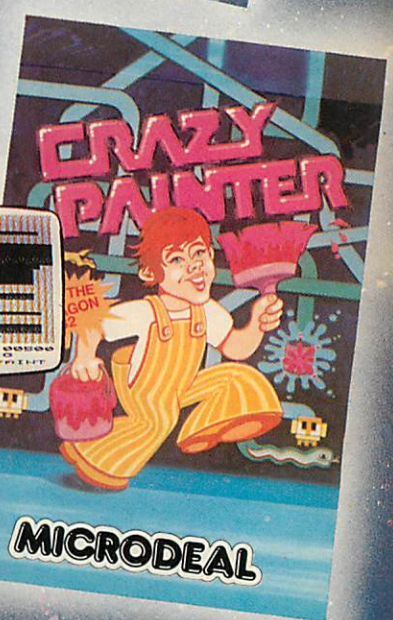
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